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THE PAPER TRADE JOURNAL.

"The Consumption of Paper is the Measure of a People's Culture."

VOLUME XXVII.—NO. 8. NEW YORK, FEBRUARY 19, 1898. WHOLE NUMBER 1242.

AMERICAN PAPER AND PULP ASSOCIATION.

THE TWENTY-FIRST ANNUAL MEETING HELD THIS WEEK AT THE WALDORF-ASTORIA.

A Two Days' Session—A Large Attendance—The Meeting Successful in Every Respect—Reports from Various Branches of the Trade—Papers on Electricity, Steam, Forestry, Hydraulics and Combinations, by Eminent Authorities—The Proceedings in Detail—The Annual Banquet—The Speakers and the Speeches.

The twenty-first annual meeting of the American Paper and Pulp Association was held at the Waldorf-Astoria Hotel, New York, on Wednesday and Thursday, February 16 and 17.

The meeting was called to order on Wednesday morning by President Hugh J. Chisholm.

Among those who were present were:

Hugh J. Chisholm, Otis Falls Pulp Company, Otis Falls, Me.

Chester W. Lyman, Herkimer Paper Company, Herkimer, N. Y.

S. P. Train, Train, Smith & Co., Boston, Mass.

A. N. Burbank, Fall Mountain Paper Company, Bellows Falls, N. H.

W. H. Sharp, Jessup & Moore Paper Company, Philadelphia, Pa.

E. L. Embree and S. H. Egolf, Columbian Paper Company, Buena Vista, Va.

A. G. Paine, New York and Pennsylvania Company, New York.

Thomas H. Savery, Wilmington, Del.

A. L. Hollingsworth, Tileston & Hollingsworth, Boston, Mass.

W. T. Barker, W. T. Barker & Co., Boston, Mass.

J. N. Mohr, Reading Paper Mills, Philadelphia, Pa.

B. C. Sherman, Taggarts Paper Company, Watertown, N. Y.

W. H. Parsons, Jr., D. F. Cowles, F. C. Whitehouse and A. T. Denison, W. H. Parsons & Co., New York.

K. B. Fullerton, Hudson River Pulp and Paper Company, New York.

F. H. Parks and W. B. Dillon, Glens Falls Paper Company, Glens Falls, N. Y.

A. M. Orr, Orrs & Co., New York.

Frank Gilbert, Troy, N. Y.

C. C. Woolworth, Fort Orange Paper Company, Castleton, N. Y.

William Whiting, Whiting Paper Company, Holyoke, Mass.

E. C. Rogers, Massasoit Paper Company, Holyoke, Mass.

C. A. Crocker and R. F. McElwain, Crocker Manufacturing Company, Holyoke, Mass.

A. W. Eaton, Hurlbut Paper Company, Lee, Mass.

A. B. Daniel, L. L. Brown Paper Company, Adams, Mass.

Wellington Smith, Smith Paper Company, Lee, Mass.

W. W. D. Jeffers, J. S. Coolidge and W. W. Jeffers, Lake George Paper Company, Ticonderoga, N. Y.

C. G. Weeks, Lakeside Paper Company, Skaneateles, N. Y.

John C. Duncan, the Duncan Company, Mechanicsville, N. Y.

Warner Miller, Herkimer Paper Company, Herkimer, N. Y.

B. F. Reist, Morrison & Cass Paper Company, Tyrone, Pa.

Olin Scott, Bennington, Vt.

A. W. Clapp, Boston, Mass.

C. W. Rantoul, Jr., and C. H. DeLang, Ticonderoga Pulp and Paper Company, Ticonderoga, N. Y.

J. F. Ackerman, Perkins, Goodwin & Co., New York.

H. W. Southworth, Southworth Paper Company, Mittineaque, Mass.

C. H. Southworth, Carew Paper Company, South Hadley Falls, Mass.

J. B. Forsyth, Stone & Forsyth, Boston, Mass.

R. B. Atterbury and Henry Atterbury, Chelsea Paper Manufacturing Company, New York.

J. A. Outterson, Carthage Tissue Paper Mills, Carthage, N. Y.

H. M. Knowles and J. A. E. Hussey, Glen Manufacturing Company, Boston, Mass.

W. D. Russell, Montague Paper Company, Turner's Falls, Mass.

William McEchron, Glens Falls, N. Y.

G. F. Underwood, Glens Falls, N. Y.

J. N. Coburn, Newton Falls Paper Company, Newton Falls, N. Y.

C. H. Dobilinski, Lambertville, N. J.

J. T. Outterson, Outterson Paper Company, Brownville, N. Y.

J. S. Crowell, Springfield, Ohio.

T. T. Waller, Piercefield Paper Company, Piercefield Falls, N. Y.

R. George Buchanan, Garrett-Buchanan Company, Philadelphia, Pa.

George E. Bardeen, Bardeen Paper Company, Otsego, Mich.

C. D. Mead, Mead Paper Company, Dayton, Ohio.

Max Miller, Herkimer Paper Company, Herkimer, N. Y.

R. Cambridge, London, England.

O. A. Miller, Central Ohio Paper Company, Columbus, Ohio.

Edwin Riley, L. M. Bickford and R. D. Ingram, Otis Falls Paper Company, Otis Falls, Me.

N. M. Jones, Katahdin Pulp Company, Lincoln, Me.

D. M. Bare, D. M. Bare & Co., Roaring Spring, Pa.

M. S. Flint, New York.

F. E. Robinson, West End Pulp and Casket Company, Carthage, N. Y.

C. L. Hamilton, W. C. Hamilton & Sons, Philadelphia, Pa.

J. A. White, Philadelphia, Pa.

Allen M. Fletcher, Rumford Falls Sulphite Company, Rumford Falls, Me.

H. C. Bainbridge, president Stationers' Board of Trade, New York.

J. S. Koster, Lyons Falls, N. Y.

C. D. Brown, C. D. Brown & Co., Boston, Mass.

George W. Wheelwright, George W. Wheelwright Paper Company, Boston, Mass.

James Conley, Manufacturing Investment Company, New York.

D. B. Rising, Agawam Paper Company, Mittineaque, Mass.

W. R. Sheffield, Stoddard Paper Company, New York.

G. W. Russell, Russell Paper Company, Lawrence, Mass.

W. E. Everett, Turner's Falls Paper Company, Turner's Falls, Mass.

E. R. Marshall, Marshall Paper Company, Turner's Falls, Mass.

G. H. P. Gould, Gould Paper Company, Lyons Falls, N. Y.

Warren F. Daniell, Winnipiseogee Paper Company, Franklin, N. H.

Porter Farwell, Montague Paper Company, Turner's Falls, Mass.

J. C. Godfrey, Boston, Mass.

Charles M. Stoever, Charles M. Stoever & Co., Philadelphia, Pa.

T. S. Safford, Camden, N. Y.

G. N. Megargee, Megargee Paper Mills, Philadelphia, Pa.

W. S. Higgins, Lake George Paper Company, Ticonderoga, N. Y.

E. H. Clapp, Penobscot Chemical Fibre Company, Great Works, Me.

F. W. Herring, Jefferson Paper Company, Watertown, N. Y.

Secretary Chester W. Lyman read the call for the meeting.

G. C. Sherman—I move that the minutes of the last meeting, as reported by THE PAPER TRADE JOURNAL, be adopted, that the reading of the same be dispensed with, and that the thanks of the association be extended to the publishers.

The motion was adopted.

PRESIDENT'S REPORT.

President Chisholm then read his annual report, as follows:

Since our last meeting a number of prominent members of the trade have been taken away by death, among them Charles Ammi Brown, of Portland, Me.; Casper S. Garrett, a name long associated with the paper interests of Philadelphia; Edward C. Taft, of Holyoke, Mass.; Charles T. Wilder, of Wellesley Hills, Mass., a man of most irreproachable character; Adna C. Denison, of Poland, Me.; H. S. Van de Carr, formerly vice-president of this association, of Stockport, N. Y.; Philip Rudolph, of Philadelphia, who will long be remembered for his geniality and business probity, beside seven members of our organization whose deaths are recorded in the annual of the association.

As indicated by the decreased number of failures, both among mills and dealers, reported in the paper business during the year 1897, the business of the past year may be said not to have been as bad as it might have been, but on the whole it has been a very trying ordeal in every line, though perhaps the paper industry has not fared worse than the other industries of the country. Briefly, the year opened with an underdemand for perhaps every line of paper and not until fall was there any turn for the better. That there has been a marked improvement, however, in business in recent months is certain. The demand is greater, resulting in some lines in higher prices, and altogether the outlook is very propitious. One of the most encouraging features of the situation to-day is the steady increase that is going on in export business. In round numbers we are now doing an export business in paper and pulp at the rate of $5,000,000 annually. To be sure, that is only a small percentage of the $276,000,000 worth of manufactured goods exported during last year, but it is still quite a handsome figure. However, it is the recent rapid rate of increase which is particularly gratifying.

Speaking in round numbers our exports of paper were:

For eleven months ending November, 1896	$2,500,000
For eleven months ending November, 1897	4,000,000
An increase of 56 per cent.	
For the month of November, 1896	,000
For the month of November, 1897	42 ,000

An increase of about 80 per cent in twelve months.

A large part of this increase was in printing, but the writing paper class is also showing very gratifying development.

Exports of pulp, while still comparatively small, give promise of greatness in the future. Our present rate of export is probably about $400,000 a year.

Now, contrasting our exports of paper and pulp with our imports, there are two observations to be made, one that our imports are still so great as to warrant careful investigation as to the possibility of turning some of our surplus capacity onto the production of the lines imported. The other observation is that apparently the turning point has been reached in the imports of paper, and that it certainly has been in the imports of pulp; for example, the imports of paper in '97 were but 1 per cent. larger than the imports of '96, being for '96 about $2,800,000 worth. While our imports were 7 per cent. in excess of our exports for eleven months ending November, 1896, in 1897 the exports exceeded the imports by 44 per cent.—quite a satisfactory turning of the tables.

Coming to the imports of pulp we find, contrasting '96 with '97, that they have been almost cut in two, even Canadian imports showing a very marked decrease. Our imports of pulp, however, are still considerable in excess of our exports, although this is not likely long to continue.

It is interesting to compare our foreign business with that of other countries, both to see what possibilities there are in the way of unoccupied fields and to show how formidable some of our competitors are. Thus Great Britain, France and Germany went outside of their borders in '96 for nearly $25,000,000 worth of paper. Contrast that with our $2,500,000 exported that year. They bought ten times as much as we sold.

Here are Russia and Italy, perhaps unknown to us as markets, importing in '95 more than our total exports. In the matter of pulp, England alone imported in '96 $12,400,000 worth. Now, as indicating hidden fields of commerce as yet untilled by Americans, the exports of Great Britain, France and Germany in 1896 amounted to $36,000,000 worth, Germany alone exporting over $18,000,000 worth. Where did it go to? It should be the business of our exporters to find out.

And finally consider Norway and Sweden, which exported in '96 the enormous quantity of nearly 500,000 tons of pulp, perhaps $12,500,000 worth. Let us consider what powerful competitors they will become, when instead of exporting this pulp they convert it into paper with modern paper machines, as they are already beginning to do, and then place the paper on the market by methods remarkably cheap and peculiarly their own.

In view of our growing aspirations to carry our product to the remotest lands, it is reassuring to consider how nature has fortunately adapted us to the task. The two great factors in paper making are, as you well know, abundant and cheap water power and wood. No nation in the world is so favored in the matter of water power. It is roughly estimated by an eminent authority that excluding the Canadian half of Niagara Falls the undeveloped horsepower in the United States is 5,000,000. According to the census of 1890 one million and a quarter horse-power was represented by the water wheels in use, so that we had four times as much remaining as we had already developed. It is in this connection that the possibilities of electrical transmission assume their greatest significance. We have not yet begun to feel the quickening effect of this great application of science. Switzerland, it is said, has received a wonderful industrial awakening through the transmission of its water power to the seats of manufacture. The introduction, therefore, into our programme, of two addresses by eminent authorities, dealing particularly with the transmission of power by electricity, it is hoped will serve to direct attention to the possibilities of the future.

No less conspicuous is our position among the nations of the earth when we consider our timber resources. It may not perhaps be generally known that this continent is the forest continent of the globe and the United States is in the zone both of greatest abundance and greatest variety of trees. In the whole of Europe there are but thirty-one kinds of trees, while the best authorities place the number of kinds of trees in the United States at 280. Some single States contain as many varieties as all of Europe. But it is not variety we are concerned with, but the particular kinds adapted to paper making, which fortunately exist in large quantities, but not so great but that we must put restraint on our prodigal treatment of them. Those among us who have weighed the matter carefully are well aware that if we as a nation are to take and permanently hold the foremost place in paper making we must begin at once to husband our resources. Fortunately the science of forestry, until recently but little known, and heeded less, is ready to point out the way, and we shall learn from three of the best authorities of the country not only why we should but how we may put in practice the principles of forestry. I hope that everyone will go away resolved directly and indirectly to do what he can to secure a rational use of this mainstay of our business.

Perhaps the next important factor in our process of manufacture is steam. If we will but intelligently utilize to its best advantage the power and heat we derive from the combustion of coal, in which particular nature has again endowed us most generously, and otherwise practice those economies in which other nations perhaps lead us and avail ourselves of the savings and other advantages accruing from the consolidation of many interests into one, we may expect to be able in the future to sell cheaper than any other nation on the earth, and at the same time make a greater profit, and continue to pay our employees higher wages than the laboring class of any other country receives.

It remains now for me to speak only of the affairs of the association. If we have succeeded in infusing a little new life into it all well and good, but this is not where we wish to see it stop. Therefore we have not only attempted to give you an attractive programme for the next two days, but such a one as will lay out work for the association in the future. We have taken initial steps toward the gathering of statistics under the auspices of the association, toward securing an adequate representation of our industry at the Paris Exposition, which aims to test most severely the relative excellence of the various products of the world, and, most important perhaps of all, we have set on foot a movement which we hope will not pause until this association finds itself permanently established in convenient and comfortable headquarters in this city under the auspices of the great paper industry centered here and affording a hospitable shelter to all those connected with the great paper industry, either from the North or South, East or West. (Applause.)

On motion the president's report was accepted and ordered placed on file.

SECRETARY'S REPORT.

Secretary Lyman read his report as follows:

Since our last meeting the association has lost by death seven (7) members, namely: Charles Tyler Wilder, B. F. Watson, Edward Chesselden Bullard, Edward Courtland Southworth, Robert Owen Morehouse, John B. Halladay, J. B. Tileston.

Through the efforts of Colonel Haskell, assisted by former Secretary Mr. Parsons, a change has been effected in the government classification of exports relating to our industry, whereby the very important item "printing paper" is now classed by itself instead of being in the miscellaneous class as formerly. Further sub-division of classes is quite desirable, and I suggest that a vote of thanks to the Treasury Department might tend to promote this end.

In view of the limited space which will be at the disposal of this Government at the Paris Exposition and acting under instructions from the executive council, I applied November 18, 1897, informally for space for an ample exhibit for our industry and have been notified that our application has been placed on file. I recommend a definite engagement of a fixed space as soon as formal application will be entertained.

Our two delegates to the National Board of Trade were in attendance at the meeting in December in Washington and Mr. Barker will report for them. As our vote in the association is determined by our membership and not by the number of delegates, it might be well this year instead of electing a new delegate to succeed Mr. Sharp, whose term has expired, to elect an alternate to Mr. Barker, who still has to serve as delegate for 1898, thus saving the expense of one delegate.

Owing to three omissions in the chain of our annual meetings, as explained in a communication to the executive council, this meeting is strictly speaking the eighteenth, instead of the twenty-first annual meeting, but I recommend, for reasons given, a vote of the association designating this meeting as the twenty-first.

Considerable thought and time has been devoted to starting a movement which it is hoped will soon lead to the association having headquarters and the paper industry a permanent home or centre. This matter will come up for consideration at this meeting.

The matter of gathering statistics of the paper industry has also been taken in hand and put in such shape that only the sanction of the association will be necessary to secure their compilation.

I have received a number of communications on various subjects requiring or inviting some action by the association, all of which I will turn over to the proper committees upon their appointment.

The catalogue of the association, recently issued with its classified list, might be made to give a commercial advantage to members of the association if it were placed in the hands of buyers. An edition for that purpose can be struck off if the association desires.

It should be noted that the work of preparing for the banquet has fallen largely upon the shoulders of Major Ackerman.

With the co-operation of the president, executive council, and many other members of the association, we have materially increased our membership and we have also put it on a better basis by eliminating that element which is too listless even to

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pay the merely nominal dues of the association.

We assumed office February 24, 1897, and at that date the membership was 182

Resignations tendered prior to February 24	5
Resignations since tendered and accepted	4
Deaths	7
Dropped for non-payment of dues	14
New members	93
Total membership February 12, 1898	245

This is the highest membership the association has ever had, as against 182 reported by my predecessor and 210 reported in 1896—207 reported in 1895, 167 reported in 1894 and 169 reported in 1892.

In 1897 there were in arrears nineteen for two years and twenty-one for one year.

In 1896 the secretary reported members in arrears for dues, eight for two years, twenty-three for three years, and ten for four years.

I am now able to report that not a single member is in arrears.

We were obliged to decline eleven applications for membership on account of their not meeting the constitutional requirements.

In conclusion, I desire to express my thanks to the president, executive council and members who have co-operated to bring about this improved condition of our roll and to acknowledge courtesies from the trade press.

On motion the report was accepted, and ordered on file.

Treasurer's Report.

Treasurer Lyman then presented his report as follows:

Treasurer's Report for Year February, 1897, to February, 1898.

RECEIPTS.

Balance in treasury February 24, 1897	$948.61
By initiation fees (new members), 84 at $10*	840.00
By annual dues, 1895 to 1896, 7 at $5	35.00
By annual dues, 1896 to 1897, 38 at $5	190.00
By annual dues, 1897 to 1898, 193 at $5	965.00
Amount overpaid on dues	5.00
	$2,983.61
Interest from Washington Trust Company	11.70
	$2,895.31
Disbursements	1,131.78
Balance in treasury February 16, 1898	$1,763.53
Estimated outstanding obligations	500.00
Estimated amount available for ensuing year	$1,263.53
Available for year 1897 to 1898	587.66
Gain of	$675.87

In previous years the balance reported on hand has been:

1893	$131.43	1896	$1,188.47
1894	356.01	1897	848 61
1895	1,273 50	1898	1,763.53

* Eighty-four members paid initiation fee; two complimentary elections; nine unpaid; total, ninety five new members.

DISBURSEMENTS.

Balance received from Mr. Parsons	$948.61	
Deficit for dinner February, 1897, and other items chargeable to previous year	280.05	$280.05
Actual amount available for 1897 to 1898	$567.66	
Stationery, etc		55.85
Printing, etc		47.40
Postage, telegrams, telephones, etc		104.87
Traveling and current expenses, etc		185.11
Annual dues overpaid and refunded		5.00
Expenses, delegates National Board of Trade		82.60
Assessment, National Board of Trade		90.00
Allowance to secretary and treasurer		4.00
Total expenditures to date		$1,131.78
Balance on hand		1,763.53
		$2,895 31

I wish to bespeak for my successor prompt response by each member to his bills for dues. The labor entailed on the treasurer by delay is probably not fully appreciated.

On motion the president was requested to appoint a committee of two to audit the treasurer's report.

The president appointed as such committee W. H. Parsons and W. T. Barker.

Report of Writing Division.

Owing to the absence of Vice-President W. F. Whiting, his report was read by his father, Hon. William Whiting. It was as follows:

Mr. President and Gentlemen—The business of the country has shown steady improvement from the election of Mr. McKinley and the passage of the Dingley bill to the present time. This improvement over the conditions which have prevailed for the past three or four years is quite marked, and seems to affect all lines of trade.

With such conditions surrounding the writing paper market the volume of its business has been gradually increasing, with now a fair demand for all grades of writing paper as a result.

The overproduction on writing paper still exists as the principal cause for this fair demand only, even with about the normal consumption of writing paper. This overproduct further holds prices at about the old basis and allows no chance for much change, even with the better conditions of trade. It also prompts the wholesale houses to order only for immediate wants, and compels the maker to carry larger stocks to meet this demand. Without this overproduction the merchant would be compelled to carry a larger stock in anticipation of his requirements. With a light demand for all kinds of paper, the writing lines seem to suffer more in proportion than the others on account of the tendency in such times to curtail expenses and have the expenditures in all departments as light as possible.

There is the same competition between the lower grades of writing and the higher grades of engine sized papers, which can be attributed in part to the overproduction.

The improvement in business has been felt in Holyoke and the immediate vicinity sufficient to keep the mills fairly busy for the past few months, and during this time it may be said that the output from these same mills has been about 80 per cent. of their total capacity.

The report was accepted, and ordered on file.

Report of the Book Division.

The report of the Book Division was presented by Vice-President J. N. Mohr, as follows:

Mr. President and Gentlemen of the Association—Without any actual statistics to guide us in a report on the book division, we can only speak of it in a general way. During the past year the demand for book papers has materially increased, which is most gratifying, and if a corresponding increase in price had taken place what an encouraging report could have been made, but, alas, the opposite is the fact, and today we find ourselves on the lowest level of prices that the country has ever known. We naturally ask, What is the cause of this? Quite a number of causes well known to most of us could be given, but the remedy for it might be brought about in our opinion by having a full statistical report of the supply and demand, if it is possible to establish and maintain for the purpose a bureau in the paper industry. Other industries have tried it with success.

The demand for the cheaper grades, such as wood papers, naturally has grown more than that for the higher grades. Yet this is encouraging because it proves that confidence is gradually returning, and it indicates that the demand for the better grades will increase correspondingly as the times improve.

The foreign demand for our book papers must not be lost sight of. The increase has been very perceptible during the year just passed, with prospects of a yet greater demand. Hitherto we have been supplying a few foreign countries. Now the call for American book papers has become quite general. Viewing the situation from this standpoint, together with the prospect of a large demand from our home markets, the outlook for 1898 should be very encouraging for us all.

The report was accepted, and ordered placed on file.

Report of the News Division.

The report of the News Division was presented by Vice-President G. C. Sherman, as follows:

Mr. President and Gentlemen—The first half of the year 1897 witnessed the most intense competition and lowest prices for news paper ever seen. These low prices were largely due to two causes. First, the consumption, on account of the general business depression prevailing, was at the opening of the year below normal, and second, a conservative estimate shows that New York State and Eastern manufacturers were equipped to produce more than 400 tons of print a day on January 1, 1897, than on January 1, 1896. Moreover, very large stocks of paper, particularly hanging, were carried over the year.

As a consequence, the year passed has been perhaps the hardest ever experienced by news paper manufacturers, and the mill that is in as good repair and financial condition now as a year ago has sufficient reason to feel contented.

In the early fall of 1897 the demand commenced to improve. This was due to improved general conditions partly, but largely because of the gradually increasing export trade, which some of the largest and wisest manufacturers had been developing for years.

Conditions have been steadily improving since last fall, and the first of this year ushers in a general advance in prices, an advance first observed in the West, where, if there had been any difference in prices previously, theirs were perhaps lower.

I regard this as one of the significant facts tending to prove the truth of my observations as to the consumption having nearly reached production.

The recent organization of the International Paper Company would undoubtedly have made its influence felt had conditions been different, but I am convinced that natural causes alone have brought about the better prices. The formation of the International Paper Company should be noticed in such a report as this, covering the news print trade for the year, but regarding that as a private enterprise I have not felt it in my province to more than note the fact.

I think, however, that it is safe to prophesy somewhat better prices and better demand during the year 1898.

The report was accepted, and ordered placed on file.

Report of the Wrapping Division.

The report of the Wrapping Division was presented by Vice-President S. P. Train as follows:

Mr. President and Gentlemen—In reporting for the manilla and wrapping paper branch of the trade there is very little to say beyond the statement that the outlook for the immediate future is more encouraging than it was a year ago.

Even at the present time the conditions noted in the manilla business, taking this branch of the trade as a whole, show considerable improvement over those prevailing during the greater part of last year.

During the earlier months of 1897 trade was very much curtailed and many of the mills running on manillas were compelled to shorten production for the want of orders. The limited demand, coupled with the desire to sell, brought prices to a very low basis; so low on some grades of wrappings that the finished product at times did not bring the cost of manufacture. Early last fall, in September to state the time, several of the prominent manufacturers made an effort to change the depressed condition of the market by advancing prices a little, especially on the lower grades of manilla wrapping.

This action had a beneficial effect, the market was strengthened and the fear of a still further advance developed a better demand from jobbers, who in turn urged their customers to lay in supplies. From that time to the present improvement has been noted; the mills have been busy, accumulated stocks have been greatly reduced, and prices have been fairly firm at the advanced quotations. As before stated, the outlook for manillas is very promising and the hope of good business stronger.

On manilla tissue, I am very sorry to say, the improvement does not seem to be so marked. While mills running on tissue are better supplied with orders than in recent past months the demand has not as yet reached a volume to elevate prices from their low level. In this particular the condition of the tissue branch of the trade is very unsatisfactory.

Attention might be directed to the fact that the export of many lines of manilla paper may, in the near future, take on larger proportions, as it has come to my notice that there are markets abroad likely to take large quantities of manilla wrappings if strong efforts were made in these directions. An increased export trade would benefit the home market and that business ought to be developed more in the future.

The report was accepted and ordered on file.

Report of Wood Pulp Division.

The report of the Wood Pulp Division was presented by Vice-President K. B. Fullerton, as follows:

Mr. President and Gentlemen—There have been very few changes in the condition of the ground wood pulp market during the last twelve months. In general, the production for the first six months of the year just ended was taken care of by the demand at home, with but very little surplus. With the summer dullness came a short demand, and, aided by the product of a few new grinders, the market declined. Measures were quickly taken to increase the small export business then existing and they met with success, so that since the late summer our exports have been sufficient to keep mills favorably located for export business running full. During the early fall low water interfered quite seriously with some mills in the northwestern part of New York State, and temporarily higher prices were asked and obtained. In the West mills have been blessed with better power than for some years past, and have been able to place their product at fair prices, for the reason that paper mills in that part of the country have been pushed to their utmost capacity to fill their numerous orders for their varied output. Mills in the Far East could not have marketed their product at home, but have been able to run full on account of their export business. With the exception of the short time during low water, pulp has hardly changed in its quotations during the year.

The outlook for the future does not seem to be very bright, for the reason that mills using pulp are arranging in many cases to make their own. Without doubt some mills that use a limited quantity will always remain buyers of ground wood pulp, but it does not seem as though the sale of this article will be as great in the future as in the past; that is, to domestic consumers. Pulp makers must depend to a certain extent upon export business to keep their mills busy, and it is believed that those properly situated for such business can compete successfully in the British market with any other country now making ground wood.

The report was accepted, and ordered on file.

Report of Chemical Fibre Division.

The report of the Chemical Fibre Division, prepared by Vice-President A. G. Paine, Jr., owing to his absence, was read by his father, Col. A. G. Paine:

Mr. President and Gentlemen—In reporting upon chemical fibre the industry should be divided into two branches, namely, sulphite fibre and soda fibre.

While these fibres are manufactured from wood by chemical processes, they differ so widely in character they can no more be considered together than book and news paper. The difference between these two fibres and the purposes for which they can be used are so well understood by all paper makers that a report from me on this subject would be quite superfluous.

Soda Fibre.—A remarkable change has taken place since the last annual meeting in the condition of the soda pulp industry. The extremely low price which then prevailed, owing to overproduction, has resulted in a largely increased consumption of this article. This, together with the stoppage of the mills at Berlin Falls, with a production of 30 tons per day, the destruction by fire of the Poland Paper Company's soda pulp works in Maine, and the introduction of paper machinery in two of the large mills in New York State, thereby increasing their consumption of fibre and diminishing the quantity for the market, has brought the consumption fully up to the capacity of the existing mills, and the consumption has been further augmented by the increased demand from foreign countries, especially France and England. There is not at this time, in all the soda pulp mills, over ten days' supply of fibre for

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the consumer. Stocks are lower than they have been for many years. Up to the present time the advance in price has been slight, not exceeding 5 per cent. on the average, and even at this advance the business is unremunerative, but all indications point to improved conditions in this industry, and while no important advance on the present price is expected, it seems certain that the manufacture of soda pulp will in the near future becomes a reasonably profitable business.

Sulphite Fibre.—During the year 1897 two new sulphite mills were constructed and put in operation—one making unbleached pulp, with a capacity of 32 tons daily, the other, bleached, with a capacity of 20 tons. The total daily product, however, shows a larger increase than the addition of these two mills, as a few of the manufacturers have increased their capacity, hoping thereby to cheapen the cost. I estimate the total daily output on December 31, 1896, at 1,029 tons. The output on December 31, 1897, was 1,219 tons, showing an increase of 190 tons per working day.

Upon the whole the business for the past year has not been profitable, and only those mills having exceptional facilities by reason of their situation and favorable wood supply received a proper return upon their investments.

Efforts in the direction of exporting sulphite would have been more successful and remunerative had manufacturers arranged to dry pulp before shipping, thereby saving over half the carrying charges. Of late some mills have been equipped with drying apparatus, which will enable the owners to market their pulp abroad at a slight profit, and it is possible that with the continued improvement in the processes of manufacture we may become quite formidable competitors of the Scandinavian and German mills for the trade of Great Britain.

Considerable improvement has been made in the quality of the sulphite fibres made by our mills, which has caused a further reduction of imports of this article, so that they now consist of specialties in high grades of sulphates and sulphites. The total imports of foreign pulps during the year 1897 amounted in round numbers to 3,500 tons.

Toward the latter part of 1897 the demand for sulphite fibre increased materially and to-day it is evident that there is no overproduction. As a result prices have stiffened, and it is to be hoped that figures will be obtained in 1898 which will leave a fair return upon the capital employed, though it should be borne in mind that the rapid depreciation of sulphite properties is often overlooked in estimating the cost of production, and the manufacturer is apt to deceive himself as to the profit on his product.

If the advance in prices is to be permanent it is quite essential that no new mills be built this year. Some manufacturers are at present increasing their capacity, but it is to be hoped that such increase of production will not assume large proportions, otherwise it will be a difficult matter to retain the benefit of the improvement which has so recently taken place in the sulphite industry.

Report of Delegates.

The report of the delegates to the National Board of Trade was made by W. T. Barker, as follows:

To the Members of the American Paper and Pulp Association:

Gentlemen—Your delegates to the National Board of Trade beg leave to submit the following report:

The twenty-eighth annual meeting of the National Board of Trade, one of the most important in the thirty years' history of the board, was held in the city of Washington during three consecutive days, beginning December 14, 1897. The attendance was large, the delegates present representing thirty-nine constituent organizations, with a combined individual membership of nearly 20,000.

An earnest interest was maintained throughout the session.

The reports of standing committees indicated a vast amount of labor and close study, many of them forming valuable additions to the current literature on their respective subjects, while the discussions were both interesting and instructive, and fully justified the existence of the organization.

It will be observed that the meeting was held a month earlier than usual, a change which is to be made permanent, and which we believe will tend to increase the influence of the board and make its recommendations more effective, as it will give the opportunity too often lost in past years of presenting its opinions to Congress before the business of the congressional session has been fully arranged, at the opening of a new Congress, or too far advanced toward the close of a final session.

The official programme contained fifty-two propositions, covering a wide range of subjects pertaining to the financial, commercial and industrial interests of the country.

Following the usual custom, all propositions of a similar nature were referred to special committees, whose reports formed the basis of discussion and action by the main body, thus expediting the business of the convention, and, at the same time, securing to each subject careful and deliberate consideration.

Thirty-one resolutions were adopted, seventeen of them carrying standing committees with authority to appear before Congress at the proper time and advocate on behalf of the board the views and opinions expressed.

We believe the fact will not be disputed that there has never been a time in the history of our country when there was greater necessity for the earnest expression of correct business sentiment than the present. No subject of greater importance since the slavery question has been before the country than that of the currency, and it is a mistake to consider the matter settled by our last national election.

President McKinley has admitted this, and with a statesman's foresight has warned the business interests of the country "to insist upon the settlement of this great question now, or else to face the alternative that it must again be submitted for arbitration at the polls."

The National Board of Trade took no uncertain ground on this question, but with almost a unanimous vote pronounced against the Government assuming or exercising the functions of a bank, and pledged its support to plans from any authoritative source that provided for a national monetary system embodying the principles of a gold standard, the payment of all obligations in gold, the ultimate retirement of all classes of United States notes, permitting national banks to issue currency to the par value of their bonds, reducing the tax on their circulation, providing for a currency to be issued by banks based on capital under proper Government supervision, and permitting such banks with a capital of $25,000 or more to be established in towns and villages of not less than 2,000 population. Such a system it is believed would at once remove all doubt as to the future standard of value in the United States, establish for it the highest credit among the nations of the world, eliminate the weak and dangerous elements of our present system, and provide a convenient, safe and elastic currency as good as gold.

On other subjects which ought to receive the attention of the present Congress, resolutions were adopted favorable to legislation permitting pooling by railroads under the supervision and control of the Interstate Commerce Commission, empowering the Interstate Commerce Commission to formulate and make effective a uniform classification of freight if within a reasonable time the railroad companies failed to do so, establishing a new department of commerce and industries, authorizing the construction of the Nicaragua Canal by the United States Government, for the continued improvement of internal waterways; for the preservation of the navigable streams of the country, and the supervision and direction of all irrigation enterprises, providing for the appointment of a permanent non-partisan tariff commission; for the correction of abuses connected with second-class mail matter; for the protection of forests from wanton destruction, and for promoting the growth of new forests.

Resolutions were also adopted deprecating all movements looking to the Government ownership of railway lines, approving the bill now pending in Congress known as the anti-scalper bill; petitioning Congress to so amend the interstate commerce law as to clothe the commission with power to carry out the original intentions of the act; requesting Congress "to oppose with all their power the incomplete Nelson bankruptcy bill," and urging the enactment of the Torrey bill; declaring in favor of the merit system in the civil service, and earnestly appealing to Congress to widen its sphere of application instead of narrowing it.

On all of these matters thus briefly referred to the votes of your delegates were cast with the majority.

In conclusion, we would suggest to members desiring a copy of the resolutions and recommendations adopted, which, if included in our report, would make it too long and cumbersome, that by application to William R. Tucker, secretary, Philadelphia, Pa., an "Abstract of Proceedings" can be obtained in pamphlet form, which was issued under date December 23, 1897, and which contains in addition to the matter referred to above the annual report of the executive council, reviewing the work of the year, together with a list of the committees continued under the resolutions of the meeting.

We would also recommend that individual views by members of this association be forwarded to the committee having in charge a subject in which one may feel an especial interest, or of which he may have special knowledge, in order that the committee may be benefited by such views and receive the inspiration that such communications invariably impart to those who are engaged in what is so largely a labor of love.

On motion the report was referred to the Committee on Resolutions.

The President—There are various matters now to be acted upon and the appointment of committees that will be able to report to-morrow afternoon will be in order. If the secretary will please report what those matters are we can appoint the committees as we go along.

The Secretary—Next, after the appointment of committees on nominations, is the subject of forestry. It is the sense of the executive council that some action ought to be taken at this meeting in regard to this matter, and that possibly a standing committee should be appointed. Therefore, it is proper that it should be referred to the committee on resolutions.

C. D. Brown—I move that the president appoint a committee on forestry.

This motion, being duly seconded, was carried.

The Secretary—The next matter is that to which I alluded in my report, namely, the establishment of headquarters. I have facts, figures and communications bearing on the subject, and I think it will be in order to have a committee on headquarters appointed.

D. F. Cowles—I move that the president appoint a committee on the question of having headquarters established in the city of New York for the association.

This motion, being duly seconded, was carried.

The Secretary—The next matter is really several matters. I do not wish to take time to enumerate them all, but they all seem to properly come under the class which should be dealt with by the committee on resolutions.

The President—It is in order that a motion be made to appoint a committee on resolutions.

W. H. Parsons, Jr.—I move that such committee on resolutions be appointed by the president.

This motion being duly seconded was carried.

The Secretary—In order that the association will know what matters will come before that committee, I will read the list of subjects:

The establishment of an international bank.

The establishment of a department of commerce and industry of the United States Government.

The Nicaragua Canal.

The establishment of a bureau of credit by the association.

The national monetary situation.

The Loud bill.

The proper designation for this meeting of the association.

The next matter relates to the gathering of statistics in the paper trade, and the committee on statistics which is appointed will have to deal with a proposition which has been made by outside parties and who are ready to undertake the work if they secure the sanction of the association.

J. N. Mohr—I move that the president appoint a committee on statistics.

This motion, being duly seconded, was carried.

The Secretary—The next matter is a very important one, and, briefly, is the Paris Exposition. A motion is now in order for the appointment of such committee, whose duty it will be to consider what steps should be taken by this association to secure a creditable exhibition.

A. G. Paine—I move that a committee on the Paris Exposition be appointed by the president.

The motion was carried.

The President—It has been the custom in the past to appoint a nominating committee to nominate officers for the succeeding year, but having a two days' session at this time I think the present occasion would be a very good one to appoint members of that committee, which would give them ample time to select suitable officers or recommend suitable persons to fill the offices for the ensuing year. Therefore a motion to appoint such a committee is in order.

A. G. Paine—I move that inasmuch as you have given us two days in which to think of this matter that the president appoint a large committee, say a committee of eight prominent members, to be selected by him and to report names for officers at to-morrow's business meeting.

This motion was carried.

The president then introduced Charles F. Scott, chief electrician of the Westinghouse Electric and Manufacturing Company, who read a paper on "Electricity in Paper Making," which will be found in full on page 151.

C. H. Delano—Mr. President, I move that a vote of thanks be presented to Mr. Scott for his very interesting and instructive paper, and that a copy of it be prepared for the use of the association. Every paper maker is interested in anything tending to decrease the cost of production, and this seems to be in the right direction, and that the preparation of the vote of thanks be referred to the committee on resolutions.

This motion was carried unanimously.

There was then a brief reception tendered to the ex-presidents and guests of the association, after which luncheon was served.

The afternoon session was devoted to papers. Charles E. Emery read one on "The Economic Use of Steam in Paper Making," which will be found on page 155, Prof. Bernhard E. Fernow one on "Foresty and Pulp Wood Supplies," which will be found on page 157; Austin Cary, one on "The Application of Forestry to the Spruce Lands of New England," which is printed on page 158, and Gifford Pinchot one on "The Sustained Yield of Spruce Lands," which is printed on page 161. Mr. Pinchot illustrated his lecture by stereopticon views.

Each of the gentlemen who presented articles was tendered a vote of thanks, the vote in each case being carried unanimously by the entire gathering rising.

The association then adjourned to Thursday at 10:30 A. M.

Thursday's Proceedings.

When the association assembled on Thursday morning papers were read by Prof. Louis Bell on the "Use of Electric Motors in Paper Making," which will be found on page 164 of this issue; by Clemens Herschel on "Some Facts in Hydraulics," which is printed in full on page 163 of this issue; by Prof. Franklin H. Giddings, on "Combinations of Capital in Relation to National Prosperity," which is printed in full on page 165.

Each of the speakers was tendered a vote of thanks, the vote being unanimous, and the entire gathering rising.

Each one present was then furnished with a pamphlet containing the reports presented, and the papers read, and also an association book, bound in red and white, and containing the constitution, lists of past and present officers, lists of members and a history of the association. In announcing the distribution of the books, President Chisholm referred to the secretary as follows:

At this point I wish, as a co-worker with my able assistant, the secretary of this association, to extend to him and properly recognize the great indebtedness which this association is under, myself as well as the rest, for the able manner in which he has performed the largest part of the work that has led up to this successful meeting. I hope and trust that you agree with me that it is a reasonably successful meeting. (Applause.) Therefore a motion of thanks extended to our secretary will be in order.

On motion of Colonel Paine, seconded by Mr. Wheelwright, a vote of thanks of the association was extended to Secretary Lyman for the able manner in which he has performed the duties of his office during the past year.

The motion was carried by a unanimous rising vote.

Colonel Paine—It occurred to me when Professor Bell was reading his paper that there was one question which comes to us every day from printers, many of whom seem to have no more idea of electricity than I have. We have complaints from time to time, not only here, but all over the country, that printers have great difficulty with paper because it is full of electricity. I do not know whether any other of our members have the same complaints, but we get them from time to time. I would like to ask if members receive that complant. As nobody answers, I presume we are the only ones who receive it. But I asked Professor Bell about it, and he said if we had such complaint from any printer that he couldn't print his paper because it was full of electricity, he would like to get some manufacturer to make him some paper which would convey and retain electricity. He said it was impossible. I inquired of him what the remedy was and what he would advise in relation to it. He said it was a very simple proposition, that a slight dampening of the atmosphere is all that is necessary; that it is absolutely impossible to create, as I understand the term, static electricity where the air is very damp, and there woud be no difficulty if the moisture in the air was sufficient.

The President—The reports of the various committees appointed yesterday are now in order. The chairman of the committee on resolutions desires to make his report.

Ex-Senator Warner Miller—The committee on resolutions begs leave to make the following report. I will first say that I found it impossible to get the entire committee together, but a majority got together, and we beg leave to make this report:

Among the resolutions and papers submitted to the committee, the first is upon the question of the establishment of an international bank. We say in regard to this that for some years past an effort has been made at Washington to have an international bank chartered by Congress, the object of which was to promote foreign trade. And during the present Congress an effort is being made and a large number of commercial bodies have indorsed the proposition. If we are to have a large and successful foreign trade we must have the moneyed institutions to enable it to be carried through. The colonial or foreign banks in the city of London, which are organized for the purposes of foreign trade, have a capital exceeding the capital of all the national banks of the United States; but we have in this country not a single bank organized for this purpose. The committee submits the following resolution:

Whereas, It is of the utmost importance to the manufacturers of the United States that every effort be made to increase our export trade to the south of us, and,

Whereas, The markets of the West Indies and Central and South America, which naturally belong to us, could, with direct American transportation and banking facilities, equal to those enjoyed by our European competitors, be supplied almost entirely by the United States; therefore, be it

Resolved, That we heartily endorse every effort that may be made to facilitate and increase our trade relations with those countries; and be it further

Resolved, That we are unanimously in favor of the establishment of the proposed international American bank, a bill to incorporate which is now before Congress (S. 753), and do most urgently recommend it to our senators and representatives in Congress, and would impress upon them the prompt passage of the bill; and be it further

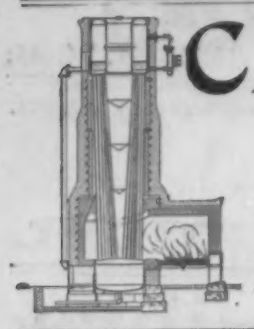
Resolved, That these resolutions be printed, and a copy sent to the President of the United States, the Speaker of the House of Representatives, and each Senator and Representative.

Adopted.

On motion, duly seconded, the resolution was adopted.

Mr. Miller—The next subject submitted was the establishment of a department of commerce. It is known to all of our members that for a number of years many petitions and resolutions of commercial bodies have gone to Congress, asking that a department of commerce and industry be established, and that a secretary should be ap-

(Continued on page 147.)



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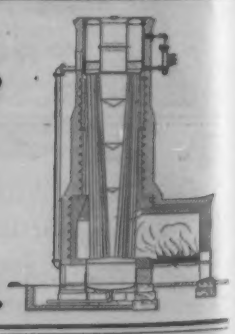

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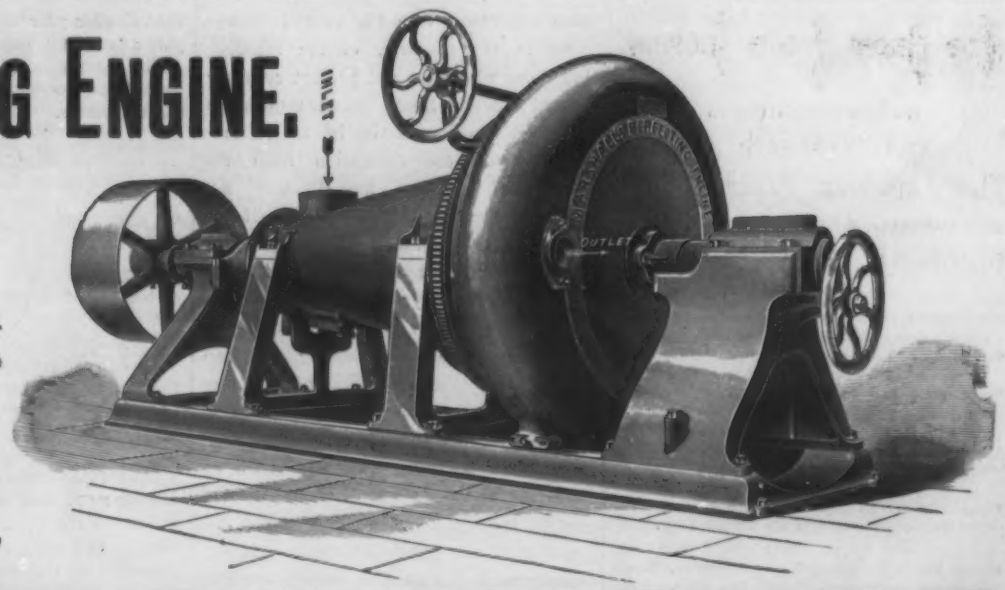

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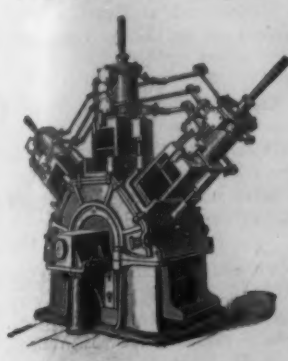

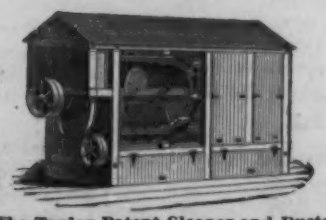

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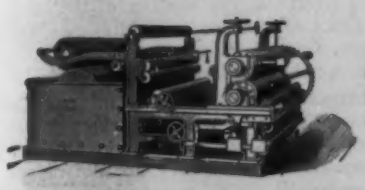

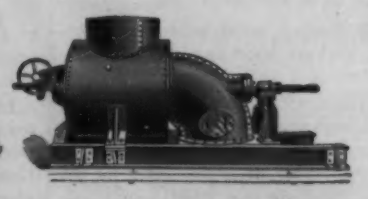

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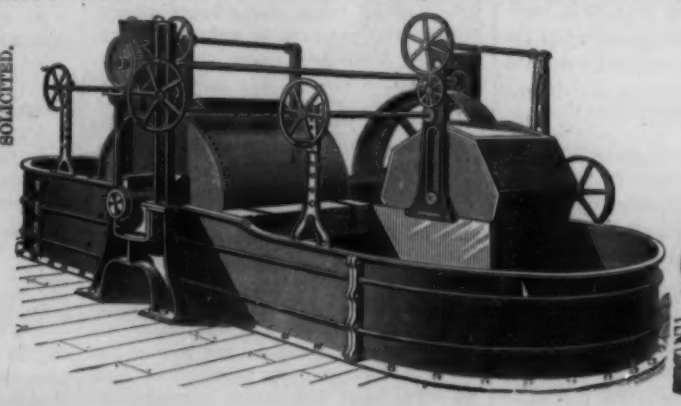

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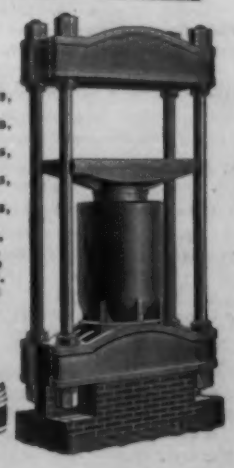

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London Office—ARTHUR MORRIS, General Manager, No. 1 MITRE COURT, FLEET STREET, LONDON, England.

NEW YORK, SATURDAY, FEBRUARY 19, 1898.

ANOTHER export order for American paper machinery is at hand, and this time the request is from Stockholm, all of which is very satisfactory. We can take care of as many such orders as our brethren across the water choose to send.

THE improved condition of business was reflected in the cheerfulness which pervaded the meeting of the paper manufacturers this week. Reports as to the demand for goods showed a larger volume of trade, and one Western man, who evidently had had the old-time query propounded to him many times, came prepared for all comers. When asked as to trade, he simply threw back his coat and displayed a large button bearing the legend. "Business is Good."

AN English trade paper reports that a large consignment of American news has been sold in London at 1d., less 5 per cent., and remarks that "the American paper trade must be pretty stony, pebbly beached, in fact, if it has to hawk its product at practically whatever figure a buyer likes to name." No, wrong again. The American paper trade is doing very well, thank you, and the news branch of the business is not so busy hunting up customers as it was some time ago.

THE MEETING.

The promise of the officers of the American Paper and Pulp Association that the twenty-first annual meeting of the body, which was held this week, would be noteworthy has been amply redeemed, and both the officers and the association itself are to be congratulated on the result. In point of attendance the gathering was the largest in the history of the organization, while the proceedings were of such a character as to commend them to the members of the trade at large. Such meetings go a long way toward drawing manufacturers into the association, and there were evident signs that the organization intends to make a determined effort to carry out some plans which will be of practical, everyday value to every paper and pulp manufacturer. Those who were present were impressed with the vast improvement in the character of the meeting, and those who were not present certainly missed much. Some Western members were on hand, and it is to be regretted that the delegation from the section of country named was not larger. The association put itself on record in favor of sound money, of the establishment of a department of commerce and industry, to be represented in the cabinet by a secretary, of the building of the Nicaragua Canal by American capital and the retention of it under American control, and of a more liberal postal policy on the part of the Government. Among other questions taken up was that of the gathering of statistics of output and consumption; and in the discussion of the question there was recognized the fact that such statistics would be of great value to the entire trade, and would enable manufacturers to have a more definite knowledge of the needs of the market than they have at present. The need of such statistical information was admitted, and the subject is now in the hands of the committee which has had it in charge. The matter of a trade headquarters was also discussed, and while the large majority of those present favored the establishing of a trade home, no definite action was taken, it being referred back to the committee having it in charge, with instructions to report in sixty days. A number of interesting and instructive papers were read by their authors, men who have become eminent in their special lines of work, and were listened to with close attention. THE JOURNAL, as is its custom, presents a full and complete report of the doings of the two days' session and of the banquet and gives up the larger part of its space in this issue in order that its readers may have an accurate and vivid pen picture of what was done.

IMPORTS AND EXPORTS.

The figures of the imports of paper have grown somewhat in the wrong direction. For the months of December, 1896 and 1897, they are as follows:

	1896.	1897.
United Kingdom....	$53,117	$40,952
Belgium	3,323	2,919
France	15,546	19,428
Germany	113,937	138,528
Other Europe.....	3,405	5,550
Japan	20,031	17,635
Other countries.....	2,733	6,847
	$212,092	$231,859

The imports for the twelve months ended December, 1896 and 1897, were as follows:

	1896.	1897.
United Kingdom....	$546,991	$575,441
Belgium	77,277	85,100
France	204,713	212,164
Germany	1,850,982	1,854,108
Other Europe.....	54,578	59,819
Japan	197,619	193,381
Other countries.....	33,298	32,872
	$2,965,458	$3,012,885

The importations of wood pulp for December were as follows:

	1896.	1897.
Germany	$2,404	7,437
Other Europe	14,123	10,890
British No. America.	47,265	26,548
	$63,792	$44,875

For the twelve months ended December they were:

	1896.	1897.
Germany	$193,573	68,012
Other Europe.....	280,394	157,209
British No. America.	556,747	354,725
	$1,030,714	$579,946

The exports of paper for December were as follows:

	1896.	1897.
Paper hangings.....	$5,663	7,567
Printing paper.....	*b*	283,681
Writing paper and envelopes	7,241	12,627
All other.....	253,637	214,467
	$266,541	$518,342

For the twelve months ended December the exports of paper were:

	1896.	1897.
Paper hangings.....	$85,035	$149,807
Printing paper.....	*b*	1,327,227
Writing paper and envelopes	105,992	149,610
All other.....	2,646,644	2,906,540
	$2,837,671	$4,533,184

b Not stated separately prior to July, 1897.

During December, 1897, wood pulp of the value of $63,132 was exported, and during the calendar year 1897 the exports of wood pulp aggregated $242,186.

The figures as to the exports of paper cannot fail to be gratifying to American manufacturers.

Watermarks.

BY DANDY.

In the second year of the reign of McKinley the Bold, and in the second month of the year and on the seventeenth day of the month, Hugh, the Rubicund, King of the Paper Makers, made a great feast to hundreds of his lords and drank wine before the hundreds. And it came to pass that there was "a hot time in the old town that night," even unto the morning.

"Sober" second thought compels the admission: It was a great night, with the accent on the verb. Even the people who went to bed early will admit that. My impressions of the feast were very vivid, especially at the time they were being "made." But, now, alas, they are slipping from me. "Slipping, slipping through my fingers, by and by, I'll lose them all." Some are pleasant, some are sad. But they're flitting, and unlike the memories of the night of bliss in the song, they will doubtless part from me real soon like, if you will pardon my Sam Bernard English. And lest Posterity might never know what it missed, let them here be written down in immortal black and white, as Judge Symonds might say.

In the first place John Hitemhard Duffy was undoubtedly the lion of the evening. He distinguished himself in several ways. Having arranged with his partner in crime, the major, to have his name take up more than its share of space in the most conspicuous part of the printed table diagram he became the observed of all observers. He became quite a favorite with the ladies in the gallery boxes after the major had made several trips upstairs and pointed him out as the Sandow of the paper trade. Languishing looks and tender glances were showered upon him, and when he disappeared for a short period and it was noticed that the gallery boxes had become vacant, it was rumored that he had consented to give a private exhibition of his muscular powers.

There are, of course, many incidents well worth recording. On the other hand, however, there are some incidents which, however worthy, might better be unwritten. In this latter class belongs the incident of how a certain paper stock importer got lost in the shuffle; what the Boston man said when he returned to his room and found that the "carrot top" pulp man had been there before him; what this same pulp man did with the V which he unexpectedly received from a borrowing friend; why the team of Franklin street paper dealers placed themselves on exhibition in the ladies' parlor "after the ball was over," and so on ad infinitum.

Worthy of mention is the touching sight which was presented by the major and the TempleCourt sulphite man drinking a toast to the future of American sulphite. Then, too, who will ever forget the spectacle presented by the major leading the crowd from a gallery box in the chorus of "There'll be a hot time in the old town to-night."

The trouble began with grace by the association's chaplain, Rev. Minot J. Savage, He asked the Divine blessing and gave thanks. He was very brief. He said: "All good and beautiful things come from Thee. We thank Thee for all good and beautiful things. Amen." Whereat the irreverent band in the gallery played "Polly Winked His Eye," and an audible smile swept over the assemblage.

After the "feed" Colonel Knapp opened the oratorical part of the programme with a blast for the "American newspaper." He convinced us it wasn't half bad. Judge Symonds was assigned to do up "The Triumphs of the Useful Arts." He did so in right royal fashion. He let loose a poetic outburst that put any of Milton's panegyrics to the blush. He also threw bouquets at Mr. Chisholm. Benny Reist was caught in the act of drinking ice water during this speech. Warner Miller made a few remarks. He said he had fixed them up with Wellington Smith beforehand. He kindly admitted that the modern newspaper was a great institution. Mr. McElroy followed with a beautiful tribute to paper generally, and Warner Miller in particular. He told how the senator and himself were wont as college boys together to make memoranda on their shirt cuffs as aids to memory. He told some good stories and caught the crowd. Chaplain Savage closed for the prosecution. His speech was the gem of the evening. His remarks were clever and well timed. He referred to the magnificent output of his New York church and offered Col. A. G. Paine as a sample of what he turned out. The colonel was duly labeled exhibit "A" and forced to bow his acknowledgments. Some thought the incident humorous.

Levy on a Mill.

[FROM OUR REGULAR CORRESPONDENT.]

DAYTON, Ohio, February 17, 1898.

An execution for $10,000 was levied this week upon the Jacoby Paper Company, of Middletown, in favor of the Merchants National Bank of that place.

It is stated that, in order to protect its claims, the bank bought the mill for $70,000 (two-thirds of the appraisement) in 1894, when the mill was owned by the Middletown Paper Company, now defunct. George Jacoby in turn bought the mill, and formed a stock company, the bank taking some of the stock.

The mill has been busy, and the levy was a complete surprise.

The mill is considered one of the best in the State, and the firm is reported to be perfectly solvent. Resumption of business is looked for at an early date.

Creditors did not want to push their claims.

The low price of paper, the large outstanding claims due the company, the small profits, and several failures in the trade, in which the Jacoby Company suffered, are given as causes for the uneasiness which brought about the levy.

M. V.

Changes, Removals and New Firms.

A. C. Brokaw, of Brokaw & Hayford, publishers, Dassel, Minn., has sold his one-half interest to A. L. Nason.

Jones & Stanley, book publishers, New York, N. Y. have been succeeded by Edward J. Stanley.

H. C. Thompson, publisher, Centreville, Tenn., has been succeeded by S. S. Speer.

Chancellor & Chancellor, publishers, Comanche, Tex., have been succeeded by the Comanche Printing and Publishing Company.

J. P. Edwards, publisher, Mt. Vernon, Wash., has been succeeded by Edwards & Holt.

Gray & Bergerson, dealers in wall paper, Green Bay, Wis., have been succeeded by N. E. Gray.

A branch of the Standard Box Company, manufacturer of paper boxes, Auburn, Me., and Rochester, N. Y., will be established at Augusta, Me.

The Pedryoid Case Company, manufacturer of traveling cases from wood pulp, will remove from Gardiner to Augusta, Me.

Spencer Brothers, dealers in paper, have opened an office in the Jones Building, Mansfield, Ohio.

Failures.

Henry P. Ross & Co., composed of Henry P. Ross and A. Clarence Isaacs, dealers in rope and twine at No. 92 White street, have made an assignment to Martin Saxe, giving a preference to the holder of a note for $800. They have been in business since April, 1895. The liabilities are $6,500; assets, $3,400.

Judgment for $4,754 has been entered against Arthur P. and Joseph A. Yorston, who composed the late firm of Yorston Brothers, formerly art publishers, in favor of Henriette M. B. Hague, on a note dated May 8, 1894, payable six months after date. Arthur P. Yorston has since been a dealer in oil paintings at No. 376 Fifth avenue.

A statement of Henry Sherry, the lumberman who failed some time ago, and president of the Park Falls Paper and Pulp Company, Park Falls, Mich., and the six companies in which he was interested, gives the liabilities as $1,250,000, and the nominal assets as $700,000.

Fires.

Kent & Davis, printers, Utica, N. Y., have been damaged by fire; insured.

Fire in the National Wall Paper Company's building at Penn avenue and Ninth street, Pittsburg, yesterday, caused a loss estimated at $125,000.

A blaze in a carload of rags on a switch track of the Boston and Maine Railroad, near the mill of the George C. Gill Paper Company, Holyoke, Mass., February 9, caused a slight loss.

Personals.

John Death is now in charge of the mill of E. H. Cunningham & Co., paper and pulp manufacturers, Sugarland, Tex.

L. D. Hanford has been made superintendent of the paper manufacturing plant which is being built at Alpena, Mich., by G. F. Fletchers, succeeding T. C. Phillips, who has been made chief engineer.

D. C. Johnson has gone to Australia in the interests of the Everett Pulp and Paper Company, Everett, Wash.

Paper Company's Officers.

The board of directors of the International Paper Company at its last meeting chose the following additional officers: F. H. Parks, of Glens Falls, N. Y., manager of the manufacturing department; Warren Curtis, of Palmer's Falls, N. Y., manager of the department of construction and maintenance; W. B. Dillon, manager of the sales department; W. D. Russell, of Turner's Falls, Mass., auditor. These officers will assume their duties as soon as suitable quarters can be secured for their offices. For the present they will continue in the management of the mills they respectively represent. One office is yet to be filled, that of superintendent of the department of woodlands. Several gentlemen have been suggested for the position, among them George F. Underwood, of Fort Edward, N. Y., president of the Kenyon Lumber Company.

General Notes.

Attention is called to the new automatic felt regulator advertised on another page. Sixteen of these felt guides can be seen running daily at 124 West Houston street, New York.

At the recent annual meeting of the Berlin Bridge Company, East Berlin, Conn., the following-named directors were elected: C. M. Jarvis, G. H. Sage, F. L. Wilcox, S. H. Wilcox, H. H. Peck. These officers were elected at the meeting of the board of directors: President, C. M. Jarvis; secretary, George H. Sage; treasurer, F. L. Wilcox; chief engineer, J. H. Edwards.

Leopold Tobianski, dealer in rags, Detroit, Mich., was last week charged with contempt of court for refusing to pay the Government for 72,000 pounds of rags he recently purchased at 1 9-16 cents per pound. Mr. Tobianski claimed the rags had become wet standing in the cars in the yards of the railroad company and were completely ruined. Marshal Winney contends that Tobianski was well aware of the nature of his bargain and that he inspected the rags before purchase.

Results, it is said, are better demonstrations than arguments. Dill & Collins, paper manufacturers, placed one of the Heintz traps, controlled by William S. Haines, Philadelphia, Pa., on their cylinder machine and with less steam than before succeeded in getting 2,000 more pounds of paper from the machine than with the trap previously used. With the old trap the firm used a 3-inch steam main with the valve mouth wide open. Now it uses the main with the valve less than at one-quarter turn; in fact, just cracked. Again, Richard L. Humphrey, in charge of the testing laboratory of the Department of Public Works, Philadelphia, testifies that by use of the Heintz hot water apparatus for three months, he was able to keep water constantly at any temperature between 100° and 212°. D. L. Griggs, superintendent of Tremont Temple, Boston, Mass., also says that by use of the trap he saved 1,946 pounds of coal for every day of December, which represents a money saving of $75 for coal alone.

Among those representing allied lines in attendance at the meeting of the American Paper and Pulp Association were: C. S. Barton, Rice, Barton & Fales Machine and Iron Company, Worcester, Mass.; C. H. Dobilinski, Pennsylvania Salt Company, Philadelphia, Pa.; T. H. Savery, Pusey & Jones Company, Wilmington, Del.; W. F. Sheehan, H. A. Waterbury & Co., Oriskany, N. Y.; Clarence Beebe, George Hamilton, New York; Olin Scott, Bennington, Vt.; Charles Wilson, and W. M. Deutsch, New York Filter Manufacturing Company, New York; E. P. Betts, Tower & Wallace, New York; C. N. Sherman, Brownville Iron Company, Brownville, N. Y.; H. W. Newton, Martin Kalbfleisch Chemical Company, New York; D. L. Nicholson and W. B. Wreaks, Westinghouse Electric and Mfg. Co., Pittsburg, Pa: A. Salomon, Train, Smith & Co., New York; Samuel Snell, Holyoke, Mass.; E. H. Conley, New York; Hugh Blethen, Scranton Supply and Machinery Company, Scranton, Pa.; Mr. Hudson, Hyatt Roller Bearing Company, New York; Charles Beebe, Maryland Clay Company, New York; E. F. Millard, E. F. Millard & Co., Waltham, Mass.; F. M. Van Wormer, Sandy Hill Iron and Brass Works, Sandy Hill, N. Y.; H. E. Tidmarsh, Friction Pulley and Machine Company, Sandy Hill, N. Y.

The W. F. Williamson Display Advertising Company, St. Louis, Mo., has been incorporated by W. F. Williamson, James H. Williamson and Jacob L. Williamson. Capital stock, $20,000.

AMERICAN PAPER AND PULP ASSOCIATION.

(*Continued from page 144.*)

pointed who should be a member of the cabinet. This condition holds in all the European governments. But thus far Congress has not seen fit to carry out the recommendations that have been made. But the committee beg leave to report the following:

Whereas, The manufacturing and commercial interests of the country exceed all other interests in value,

Resolved, That we favor the establishment by the general Government of a department of commerce and industry and the appointment of a secretary in the cabinet.

On motion of Mr. Barker the resolution was adopted by unanimous vote.

Mr. Miller—Another resolution was submitted to the committee upon the monetary situation, but the shortness of time and our inability to get the full committee together decided the committee in confining its report to the mere expression contained in this resolution:

Resolved, That we favor the maintenance of the gold standard and a sound currency.

On motion of Mr. Wheelwright, the resolution was adopted unanimously.

Mr. Miller—Another subject submitted was that of the Nicaragua Canal. We have a resolution regarding that. I simply desire to say that I had nothing whatever to do with making it; that Colonel Paine is the father of this resolution.

Whereas, The commerce of the Orient is of the very greatest importance to the United States, and

Whereas, Trade is largely controlled by the shortest and cheapest lines of transportation; therefore

Resolved, That we favor the speedy building of the Nicaragua Canal by Americans and its retention under American control.

On motion of Mr. Parsons the resolution was adopted.

Mr. Miller—Another proposition submitted to the committee was in relation to certain bills now before Congress in regard to postal matters. The committee thought it unwise to make any specific recommendations in regard to any particular bill, either for or against; but present this resolution upon the general subject:

Whereas, The postal service is the promoter and distributer of intelligence and one of the chief instruments for the development of commerce, both domestic and foreign, therefore,

Resolved, That we favor the increase of mail facilities at reduced rates when possible and the payment of liberal compensation to American ships carrying mails.

On motion of Colonel Haskell the resolution was adopted.

Mr. Miller—Another paper which came before the committee is in regard to the proper designation of the present meeting of the association. This organization has been in existence twenty years, and a meeting has been held every year, with, I think, two exceptions, and in one or two years two meetings have been held; but the secretary and the officers were uncertain as to what this meeting ought to be designated, whether the twentieth or the twenty-first. After careful consideration by the committee we present the following:

Resolved, That the meeting of February 16 and 17, 1898, be styled the twenty-first annual meeting.

On motion the resolution was adopted.

Mr. Miller—This resolution that I hold in my hand came to the chairman of the committee after the meeting of the committee, and therefore has not been considered at all. I present it, therefore, personally, for the meeting to take such action upon as it pleases:

Whereas, The members who are dealers are sufficiently numerous in the opinion of the association to warrant their being grouped in a class by themselves, therefore, be it

Resolved, That a Division, to be known as the Dealers' Division, be and hereby is created, and that there should be a vice-president for this division.

The resolution, on motion of Mr. Miller, was laid on the table.

Mr. Miller—There was one other subject submitted, designated the question of credit. No resolution was formulated, and the committee voted no upon the proposition of submitting a resolution. So I simply return the paper to the secretary. I find here a resolution with regard to forestry, referred to the committee of which I am chairman. Only a portion of us have been able to get together this morning. The resolution reads as follows:

Resolved, That the American Paper and Pulp Association believes that the Congress of the United States should provide a generous fund for the gathering of information either immediately, or in connection with the next census, in regard to the status of our forests, and further that it believes that the various State Governments should rigidly enforce all statutes now existing relating to the regulation and care of timber land, and should enact such further legislation as is necessary to ensure ample protection from fire and other destructive elements.

And Resolved, That it endorses the principles of forestry, and urges its members to study and apply the same to their holdings.

On motion, the resolution was adopted.

Colonel Paine moved that the committee on resolutions formulate and present to the secretary the vote of thanks passed after the reading of each paper, and also include in that vote of thanks the delegation to the National Board of Trade, of which Mr. Barker is one of the members.

The motion was carried unanimously.

The President—We will consider the committee on resolutions still in session until they have discharged their duty in that respect, after which they will be discharged.

REPORT OF THE COMMITTEE ON STATISTICS.

J. N. Mohr was called on to present the report of the committee on statistics.

The President—I would like to say that this special matter that we are now considering is one that may prove of great benefit to the association; and still it might be started, if started at all, with questionable propriety. It requires very careful consideration, because half done is worse than not done at all. It requires a unanimous, or almost a unanimous, support of the various manufacturers of the various lines of goods in order to make it of any special value. Therefore in appointing that committee I endeavored to put on it representatives of each line of goods. There is nothing that is so important in the trade line, and should have more full consideration than this resolution now to be acted upon.

Mr. Mohr read the following letter from the treasurer of the Howard Lockwood Publishing Company, offering to begin the collection of statistics:

In all industries the value of reliable statistics is generally acknowledged, but it is also generally conceded that no really reliable data can be obtained unless with the co-operation of the individual members of each particular industry.

For many years past it has been the pleasure of the management of THE PAPER TRADE JOURNAL to submit to its readers and to this association a table showing the daily capacity in pounds of the active paper mills of the United States, which, with the exception of the report of the United States Census Bureau, has been the only means of following the development of the paper trade.

It can hardly be considered, however, that this table suffices for the wants of those who desire to be absolutely correctly informed as to the exact conditions of the different branches of the industry, and chiefly for the reason that the figures presented give only the daily capacity of the mills in operation at the time of sending out the reports, which is but little or no indication of the actual production of the different classes of paper, which is by far the most important feature of any reliable statistical record.

In view of the tremendous developments that have been made in the output of paper since 1881, in which year the total daily capacity was 5,800,000 pounds, as against 13,500,000 pounds in 1891 and 26,300,000 pounds in 1897, it would seem that the time has now come when an effort should be made to compile very thorough statistics, which would show at a glance the progress and development that was being made along every branch of the trade.

With this object in view, I have had prepared and have with me here a draft of a report which I propose to send out twice a year to every paper and pulp mill throughout the country, should the idea meet with the approval of this association, for, unless, as I previously remarked, we can rely upon the co-operation and obtain the confidence of each individual manufacturer, it would be impossible to compile such a general statistical record as I have in mind.

The draft of the return which I now beg to submit to you is by no means so complete as I should hope it might become in time, but knowing the objections that most feel in giving away private details of their business, I have sought to limit the amount of information to be given until time has shown to all concerned the value of each one disclosing still more of the details of their business for the benefit of being able to profit by the fuller information which a more collective statistical table could disclose.

The information to be asked for is, as you will see, the actual production of the various classes of paper you have made from January to June; the estimated possible production during the same period, on a basis of all machines running full time, and finally the quantities of paper on hand at both the beginning and end of this period.

This last information, when put into a collective form, should prove of considerable value in conjunction with the collective actual and possible production. It will be observed that I have sought to emphasize the fact that this report is to be considered as strictly confidential. I desire to say here that if it is the sense of this meeting to approve of the suggestion which I have submitted, I am willing to pledge myself that these individual returns shall only be used in compiling the general tables, and that no one, apart from an assistant, shall ever see these reports, which will be destroyed as soon as entered.

I now take pleasure in submitting the draft of a general table of statistics, as it would be presented to you as soon as possible after the individual reports had been received, and as I have said in relation to the individual reports, I should hope that the information given therein could soon be greatly extended.

This general table will tell at a glance the actual production of paper in any one or of all the States; the actual and possible production of each different class of paper, and the supplies on hand on the first and last days of the period for which the record is being compiled.

I have added two subsidiary tables, one for the purposes of showing the fluctuation in the exports and imports, and the other to show at a glance the total number and sizes of the paper machines in this country; these two drafts having been drawn out somewhat hastily, it is probable that some of the members present may be able to suggest some changes that would improve the general scheme, and which I should be very glad to receive.

In conclusion, I would ask the association, if it decides to consider this proposition favorably, to put itself on record as thoroughly approving and indorsing the scheme, with a view of influencing those who may not be present to-day to do likewise, for it is easy to see that to be of service this return should include every mill in the country.

L. ALERS-HANKEY.

February 15, 1898.

Mr. Mohr then made the following statement:

I might say in connection with this matter that the Iron and Steel Association, of which Mr. Swenck is the general manager, has been compiling statistics for a number of years, and he tells me they are absolutely correct. He states that the blanks are sent out the first of every month, or the last day of the month, and before the 10th of the following month they have a report of all the iron and steel manufactured during the previous month, the amount sold and the amount on hand. You can readily see what an advantage it is to the iron men. For instance, we will say that 100,000 tons of iron were manufactured in the month of December and 90,000 tons sold, showing a surplus of 10,000 tons. In the month of January say 120,000 were sold, and only 100,000 made, showing a deficiency of 20,000. The prices are governed by the output and the quantity sold, and you can readily see to the manufacturer it is quite an advantage.

C. C. Woolworth—What do you think of the practicability of doing a similar thing in the paper line?

Mr. Mohr—I think it is practicable as well as in the iron trade. Iron and steel cover almost as wide a range as paper. They take the iron, the steel, the merchant iron, the bar iron, the skelp iron, and they take the iron ores along with it; so that it is probably as much diversified as the paper industry. Mr. Swenck says these reports are absolutely correct. One mill failed one month to hand in its report, but they simply took the average for the previous months and put it in, so it was as nearly correct as it was possible to make it. They do not individualize the report at all. As the reports come in they are tabulated and then destroyed, and the aggregate given.

Mr. Woolworth—Do you think you can get accurate reports from the paper manufacturers?

Mr. Mohr—I think so. If my usual product was 100 tons a month and I was only producing 80 or 90 tons, I would not hesitate to give that report in confidence. I do not think any manufacturer would object to doing that. For my part I think it is worthy of trial.

G. W. Wheelwright—I think if anything of this kind is to be attempted that certain restrictions will have to be imposed, so that it will be entirely certain to be of a confidential nature. And I suppose Mr. Hankey would probably have a private list which would simply have the names of the concerns, and against each a number; so that when they came in they would go into his general bureau with simply the numbers, no one except Mr. Hankey knowing who the numbers represent. Of course they would have to show what State they came from in order to carry out his idea. And I suppose, of course, that Mr. Hankey would be willing to confer with the secretary or with some committee, and perhaps improve on the blanks that he shows here to-day. If we attempt to get too much at first we will not get anything. The plan will have to be fairly simple, so that it does not require a very expert bookkeeper to fill it out. Otherwise it will go into the wastepaper basket, as most all our census reports would if the law did not oblige their being filled out.

C. D. Brown—The woodboards people are doing about that thing. Ninety-five per cent., perhaps more than that, of the boards that are made are reported to a secretary; and we know at the end of each month how many boards are on hand; how many have been sold, how many exported, etc. It is carried through very accurately, and is a very good thing. It seems to me it can be simplified in this case to meet the requirements. That is simply known to the association. It is simply for their own benefit and their own information—inside information.

Mr. Wheelwright—We propose to disseminate this information for the benefit of the paper trade generally, and it is worth while to give the matter deep consideration, whether we are prepared to furnish these statistics or are likely to. I was on this committee, and I must say that I feel considerable hesitancy in recommending action on this matter.

Mr. Mohr—I might say that the Iron and Steel Association issue their bulletin once a month to the subscribers.

Mr. Brown—It reaches all the consumers of iron and steel—it is public property?

Mr. Mohr—Yes; and largely their prices are governed by the condition of the trade; the condition of the stock.

The President—I think, myself, in a broader sense, the question of 2 per cent. increase over and above what is consumed has led up to a decrease on the other 98 per cent. of from 5 to 10 per cent. on the price of the whole. If there had been a practical way by which the better and stronger mills throughout the country could have known how much it was necessary to reduce the production in order to steady the price, that instead of reducing the price of paper 10 or 15 per cent. and keeping the production up, there would have been a tendency to lead up in the direction indicated. I quite agree with Mr. Wheelwright in certain directions. I should hesitate whether or not to say that this is the best thing. It is the best thing if we can get into lines of strict confidence, and have the whole industry do it, but we represent only a small proportion, apparently, of all manufacturers. There are some ten or twelve hundred mills, and our membership would indicate that there are a great many that we do not have any direct or indirect influence on, so that even what we would agree to do among ourselves would not govern the actions of those outside of our organization. I am very desirous, personally, that this matter of statistics shall have careful consideration. I believe in the principle of it. I believe that a great deal of the ruinous competition that has been brought about and the depression in the values of these great manufacturing plants engaged in the manufacture of paper has been caused by irresponsible men having very small interests relatively in the properties. They are either interested simply in the commissions or the sales; and if this information came the first day of each month to the real owners of these properties they would call a halt. Therefore, if you can get enough in number here to go into it conscientiously, with the intention to give it a good trial, I think it would be a splendid thing. As to whether that can be done or not I would like to have an expression of opinion.

Mr. Wheelwright—It was not my intention to antagonize such a movement, but I saw clearly many difficulties, and I wanted those difficulties to receive some consideration. Otherwise the attempt will be sure to be a failure.

Colonel Paine—I was asked if I would go into it. I should be very glad to.

The President—Will you indicate by discussion here what form the matter had better take? The question of adopting it here as an association would not be far reaching enough. Possibly I do not know enough of the policy on the part of the gentleman who has kindly consented to gather these statistics for us, how he is going to reach manufacturers outside of our association.

Mr. Alers-Hankey—Mr. President and gentlemen, I thoroughly and naturally realize that a question of this nature must be dependent in a very great degree upon the confidence of the manufacturers toward anyone who undertakes to compile such statistics as these. I think Mr. Wheelwright has suggested the point in the direction where the shoe, as I may say, begins to pinch. He wishes to know how I am able to satisfy the gentlemen present how it is possible to keep the information which is asked for in these returns concealed from everybody else. Of course in the few remarks which I submitted to the secretary I explained that these two reports or returns here were compiled a little bit hastily, and that I have not possibly gone into the matter quite so extensively as I would have done if I had had more time. But I would like to explain that one of the ideas about this matter is as follows: The sheet which I have in my hand, you will notice, is marked "Strictly confidential" in more places than one; and you will notice also that the name of the corporation or firm or individual to whose address it is to be sent occupies a place at the head of the paper. These blanks will be sent to every paper and pulp dealer in the country, and I sincerely hope with success, because if it was only done in a half-hearted way we should never be able to compile such a table as you require. This paper will be sent out in an envelope, which will be addressed to me personally, and on its receipt my idea is to tear off this head and destroy it. I should have a copy of the directory issued by our corporation specially marked and reserved for this particular object; and as those returns came in to me they would be immediately checked off—not the information that was given, but simply to show that the mill had answered; and the other part containing the data would simply be filed until such time as it could be compiled in a general statistical table. I may say that I understand that this suggestion is one that occupied the attention of this association some four or five years ago, and an effort was made, I believe, in this very direction. The reason it failed was that too much information was asked for. It has been in this particular instance our object to ask for as little information as we possibly can, with the hope of inducing gentlemen to supply that information, and that when they came to realize and appreciate the benefits, both to themselves and to the trade in general, that might be obtained from a close following of these statistics, they would be willing in time to add still further to the information asked for here. The principal trouble is this: That unless it is generally adopted by all the manufacturers of paper and pulp the information which we may be in a position to give you is not such as you want, because it would not be sufficiently complete.

I have been asked to explain how we propose to reach the manufacturers who are not here. To that I can only reply that by constant correspondence, with your indorsement, is the only means of reaching them. If this association consents to our sending out and trying to compile these statistics I think it will have a great deal of weight with those who are not here; because, naturally, we should take advantage of the fact that it has been indorsed by you, and therefore you were willing to give us that information; and naturally we should make use of that fact in applying to those who are not here to-day to give similar information. There are some other subjects in connection with the matter which may possibly be open to criticism; and if any gentleman could offer any suggestion which might help to simplify these returns or add to their value in making further headings or divisions, they would be received with the greatest pleasure, and would be acted upon as far as it could be done.

D. B. Rising—I understand this proposition is for the benefit of the manufacturers wholly.

The President—Yes.

Mr. Rising—If we have a permanent secretary I think the whole business should be done through him; that the reports from the different mills should go to him only, and then be returned only to the manufacturers. I do not think this matter should be left in such a way that it could go before the buyers. That would be the only way in which I would be willing to give these statistics of our production. I should not care to have it published, and I should not care to have it go to the general public, but only to the manufacturers. As I understand it, it is for the benefit of the manufacturers, and they are to be controlled in their production in the amount of goods on hand at the end of each month. As suggested by Mr. Wheelwright, this could be done by numbers so that the different mills would know that certain numbers made so much paper and had so much on hand. It is a very delicate subject to treat on, and a subject that ought to be handled very carefully and very confidentially.

J. T. Outterson—I heartily indorse the view of the last speaker, and say that if we are to enter into a matter of this kind it ought to be through the association and manufacturers first, and afterward we can decide whether to disseminate the information among the trade.

Mr. Parsons—I think we are indebted for the suggestion to the gentleman presenting it. It seems to me it might be very valuable if carried out. I fancy there are some of us here who would hardly be prepared to give a decided answer at this time; and this suggestion occurs to me—I am going to offer it as a resolution—that the committee be continued, and that they report upon this matter at the next annual meeting.

The President—Would you be willing to modify that to the extent that this committee, after carefully investigating the matter, should then call the executive council, or the president of the executive council, in a conference with that committee, and see whether they would desire to recommend it without the co-operation or indorsement of the association? I simply make this suggestion. A year is a long time to put off a thing if it is a good thing.

Mr. Parsons—I would like to withdraw my resolution and substitute this: That the whole matter be referred to the executive committee.

(*Continued on page 165.*)

Manufacturing News.

EASTERN STATES.

J. H. Walker, paper manufacturer, Burnside, Conn., recently took a contract for 100 tons of writing paper, which will keep his paper mill busy for at least a month. Mr. Walker reports that the mill has more business ahead than at any time in the past three years. It is running full time and employs ninety hands.

F. J. Carsely, Dexter, Me., will handle about 3,500 cords of pulp wood this winter if the snow does not get too deep to prevent its delivery at the railroad stations. Of this amount, 1,000 cords have been purchased for shipment at Easton and 500 cords at other stations. He expects to ship 800 cords from Mainstream.

The Missisquoi Pulp Company, Sheldon Springs, Vt., is shipping two carloads of pulp daily.

The Manufacturing Investment Company, Madison, Me., will send about fifty tons of its best pulp to Newcastle, England, and Leith, Scotland, for trial.

The foundation is being laid for the addition to the Uncas Paper Company, Norwich, Conn.

MIDDLE STATES.

The New York Filter Manufacturing Company, New York, recently closed contracts with the Mead Paper Company, Dayton, Ohio, the Traders Paper Company, Lockport, N. Y., the William Mann Company, Lambertville, N. J., and the Laurentide Pulp and Paper Company, Grand Mere, Que., for large filter plants.

It is understood that a material enlargement of the plant of the Howland Paper Company, Sandy Hill, N. Y., has been in contemplation for some time, necessitated by constantly increasing business. Plans have been prepared by an expert mill architect of Worcester, Mass., comprehending a general remodeling of the mill property, together with extensive additions.

The Pusey & Jones Company has received an order for two mammoth paper machines to go to Stockholm, Sweden, the total weight being nearly 1,000,000 pounds.

WESTERN STATES.

Large orders from Australia and Japan were recently received by the Everett Pulp and Paper Company, Everett, Wash.

I. N. Miller and G. P. Wood, of the Kokomo Pulp and Paper Company, Kokomo, Ind., have taken a five years' lease of the plant of the Howard Paper Company, and will put it in operation to its full capacity at once, giving employment to forty men.

The company which has the contract for the erection of the plant of the Carlyle (Ill.) Paper Mill Company has purchased fifty cars of brick and stone at Menard, Ill.

Seven carloads of news were recently consigned to New Zealand by the Willamette Pulp and Paper Company, Oregon City, Ore. It was put up in rolls and bales. The largest rolls were 7½ feet long and probably 3 feet in diameter. Each contained 5,900 yards of paper, and weighed 1,400 pounds.

The United Alkali Company, Bay City, Mich., will erect 100 houses for its employees.

The River Rouge Land and Improvement Company has finally sold to the Pennsylvania Salt Manufacturing Company, Philadelphia, Pa., 100 acres in Monguagon township, just south of Wyandotte, Mich., for $55,000 cash. The property has a river frontage of 1,700 feet. The new plant will cover 60 acres and give employment to 2,000 men.

BOSTON.

[FROM OUR REGULAR CORRESPONDENT.]

Eastern Office PAPER TRADE JOURNAL,
64 Federal Street,
BOSTON, Mass., February 18, 1898.

Well! Well! Well! Is it possible? The gentlemen who at last have succeeded in bringing about the International Paper Company are now branded as a band of conspirators, organized to levy blackmail upon the intelligence of the country. So says the World, of New York.

And news paper, according to that authority, is to be advanced $8 a ton. Now, if the paper manufacturers by their combination can get $5 a ton more for their paper they will not be getting any too much. The fact is, the paper manufacturers, owing to the severe competition, have for some years past been at the mercy of the big newspaper publishers, and it is only fair that conditions have at last made it possible to put the boot on the other leg.

To the charge made by the World is the following statement, made by the Hon. Waldo Pettengill, of Rumford Falls, Me., who was recently interviewed on the subject. This is what Mr. Pettengill is reported to have said:

"The paper trust will not advance the price of paper. Indeed, paper is likely to become cheaper rather than dearer. There will be a movement to cut off long credits, which bolster up weak concerns at the expense of the strong. This long credit system encourages mushroom newspapers, which run for a time and then run into the ground, at the expense of the paper makers and even of the wage earners. In fine, the paper trust will try to live up to its motto, which is to cut off the expense of useless organizations and cut off hazardous credits—all of which will benefit reputable newspapers."

So let the World content itself with patience and rave not. If the worst that its management predicts does come to pass, they can build a paper mill so as to save the extra cost of paper. They have a very large surplus account that could be put into a news mill plant, and they could run it until the misfortunes that befell Brother Singerly were visited upon them. Have not the newspaper publishers a little combination of their own? Then why not let the news paper manufacturers combine, and they have.

"The Manufacture of Paper" was a theme presented in an address by Charles W. Ward, before the members of the citizenship class, a few days ago, at the South Congregational Church. Mr. Ward is connected with S. D. Warren & Co., paper manufacturers of this city, and is well qualified to talk on the processes incident to the production of paper. To the ordinary layman Mr. Ward's address was very instructive, and the reports of his remarks, as published in the city press, made good reading, but to the readers of the PAPER TRADE JOURNAL a report of the address would not prove so interesting, since they all know how paper is made. And yet there are some statements that Mr. Ward made that will bear repetition in order to familiarize certain facts, since they come under the head of statistics. One of his statements was that the total production of paper in this country was 8,000 tons a day, New York leading in the amount produced, with Massachusetts second in volume of production. In fine papers, however, Massachusetts stands at the head of the list, said Mr. Ward, more than one-half of the total production of high-grade papers being turned out in this State. For the production of cheap news paper Massachusetts is not so favorably situated in regard to wood as a material and water as a power as are some other States, and in consequence its production is only about 125 tons daily of the 2,000 tons produced. "The amount of news paper exported," said Mr. Ward, "is increasing, owing to an overproduction in this country, but, as a rule, the English newspaper publishers dislike to use American news paper." Just why this dislike exists Mr. Ward did not say, leaving his hearers to draw their own conclusions.

Reports from the various city jobbers are somewhat encouraging, business being very fair to good.

Mills are seemingly better supplied with orders and are running closer to capacity than for some time past.

To-morrow (Thursday) the award will be made to furnish the schools of Boston with paper. All the city dealers have bids in, and are anxiously awaiting the decision of the school committee. The volume of the business amounts to about $6,000 per year.

It is reported in local trade circles that Harry G. Bixby resigned the office of treasurer of the Nashua Card and Glazed Paper Company at its recent annual meeting, Dr. Currier, a wealthy gentleman of Nashua, N. H., becoming treasurer. James Bartlett has been appointed general manager of the company.

Daniel F. Knight, for many years a member of the Boston stationery trade, but more recently located in the West, has made a connection with the J. P. Jordan Paper Company, of this city. At present Mr. Knight will put his time in at the company's Congress street house.

N. M. Jones, of Lincoln, Me., and F. C. Whitehouse, of Brunswick, Me., passed through town yesterday en route for New York to attend the convention of the American Paper and Pulp Association.

Others leaving yesterday for the convention were Col. S. P. Train, James B. Forsyth, Charles D. Brown, George W. Russell, Adna T. Denison, Charles Wilson. H. T. Bartow, Charles A. Brown and others will leave to-day. Boston will be well represented at the banquet.

Some of the trade representatives seen in town the past week were: W. S. Holt, of Manchester, N. H.; Mr. Bartlett, of Nashua, N. H.; W. A. Whitney, of Sunapee, N. H.; Charles S. Mayo, of Lawrence, Mass.; Fred. Temple, of East Pepperell, Mass.; C. M. Burnett, of Turner's Falls, Mass.; John D. Carson, of Dalton, Mass.; Oscar Hartwell, of Springfield, Mass.; F. H. Sturtevant, G. M. Holbrook, C. H. Davenport, of Holyoke, Mass.; James Logan, Mr. Thompson, of Worcester, Mass.; Benjamin M. Jackson, Lowell Emerson, Walter H. Stearns, J. S. Linton, Mr. Crawford, Mr. Hawes, of Pawtucket, R. I.; C. W. Rantoul, Jr., of Ticonderoga, N. Y.

And now for a hack to catch the 1 P. M. train for New York to join the Boston delegation at the big banquet.

DELESDERNIER.

Mortgages, Etc.

[In the appended list R. signifies a renewal of a pre-existing mortgage; B. S., bill of sale; T. D., trust deed; T., trust mortgage; F., foreclosure; Real, a mortgage on real estate; C., conveyance realty; Pr., printer; P., publisher; W. P., wall paper; B. & S., bookseller and stationer; S., stationer; P. B., paper boxes.]

MIDDLE STATES.

Mortgagor.	*Amount.*
Oliver C. Gardner (P.), North Adams, Mass.	$2,000

MIDDLE STATES.

Richard Twelves (S.), Camden, N. J.	[illegible]
William V. Ramsey (Visitor Publishing Company), Flemington, N. J	2,000
John H. Henry (Pr.), Ithaca, N. Y.	700
Frederick J. H. Berg (S.), New York, N. Y.	[illegible]
Consolidated Music Publishing Company, New York, N. Y.	700

SOUTHERN STATES.

Ackerley Printing and Bookbinding Company, Norfolk, Va. (T. D.)	1,400

WESTERN STATES.

J. J. Vanderburgh (P.), Selma, Cal.	700
Douglass & Reed (Prs.), Chicago, Ill.	3,000
R. V. Edmonston (Pr.), Chicago, Ill.	1,700
Frank W. Bailey (Pr.), Chillicothe, Ill.	1,000
B. J. Terry (P.), Elgin, Ill.	300
R. S. Hook (Pr.), Galesburg, Ill.	400
W. S. Childress (P.), Parra, Ill.	1,000
Sheckley Brothers (P.), Eldora, Ia.	900
Thompson & Lyons (P.), Indianola, Ia., H. Thompson	600
Bancroft Printing Company, Sioux City, Ia., David Gibbs, Jr., one-half interest (B. S.)	1,000
O. O. Outcalt (P.), Burlington, Kan.	500
W. A. Morgan (P.), Cottonwood Falls, Kan. (C.)	1
B. E. Burnett (Pr.), Parsons, Kan.	500
N. M. Shellfish & Co. (Prs.), Detroit, Mich. (B. S.)	400
O. R. Proctor (P.), Clyde, Mo.	400
W. T. Fletcher (Pr.), Kansas City, Mo. (Real)	1,500
Nathaniel M. Drake (P.), St. Louis, Mo. (B. S.)	1,000
L. A. Williams (P.), Blair, Neb. (B. S.)	—
L. A. Williams (P.), Blair, Neb. (C.)	5,000
H. S. Stuff (Pr.), Lincoln, Neb.	500
Western Envelope Company, Omaha, Neb. (B. S.)	3,800
Charles J. Brenholtz (P. B.), Zanesville, Ohio (Real)	8,000
L. M. Mann (P.), Portsmouth, Ohio (B. S.)	—
L. M. Mann (P.), Portsmouth, Ohio (C.)	2,700

JUDGMENTS.

Boyd's Directory Company, Washington, D. C.	540
Hitchcock Publishing Company, New York, N. Y.	742
Lowe & Stinson (B.), Asheville, N. C. (B. S.)	1,650
H. B. McNeal (W. P.), Middletown, Pa.	1,907

An advance in the price of rope has just been made by the leading cordage companies of the country on manilla and sisal goods. The price for wholesale lots of manilla is now 6 cents per pound, and 6¼ cents for smaller quantities, and for sisal 5¼@5½ cents respectively, the advance being about one-quarter of a cent in both cases.

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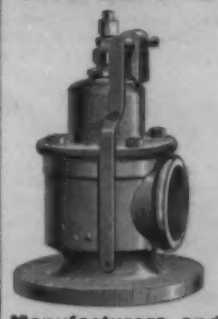

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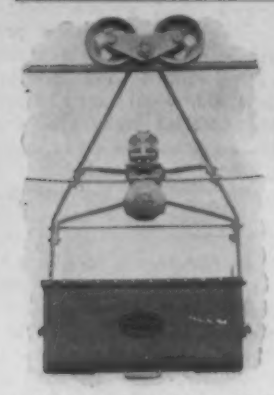

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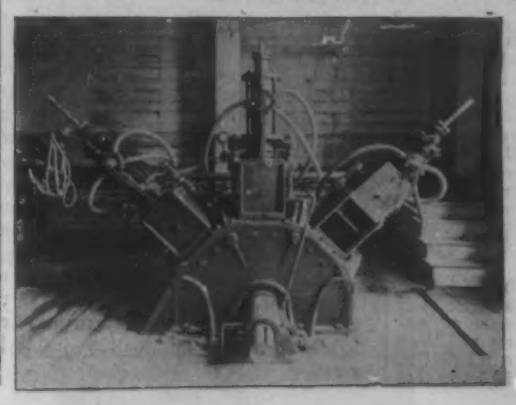

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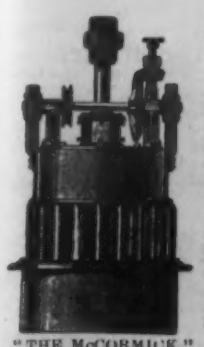

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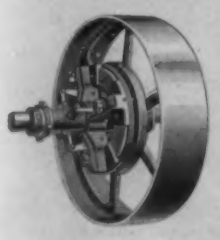

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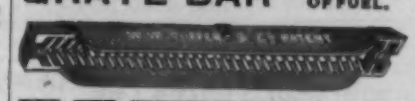

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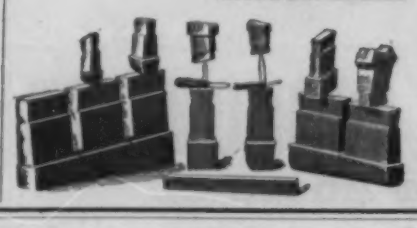

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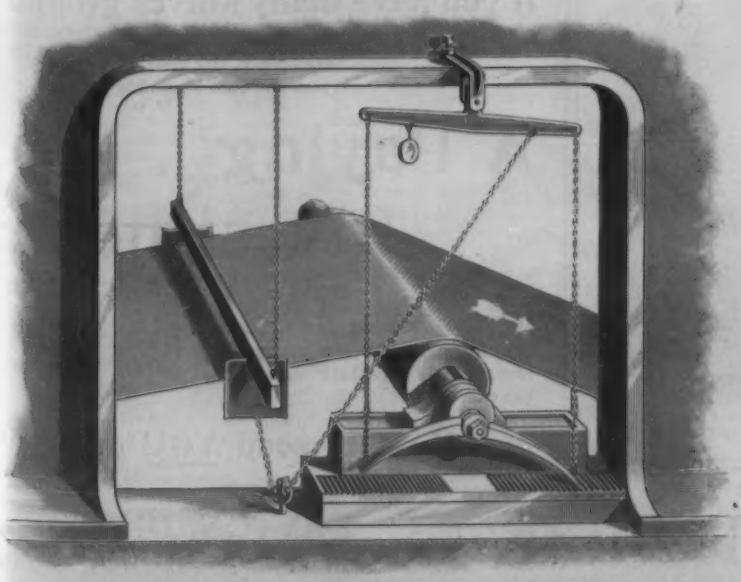

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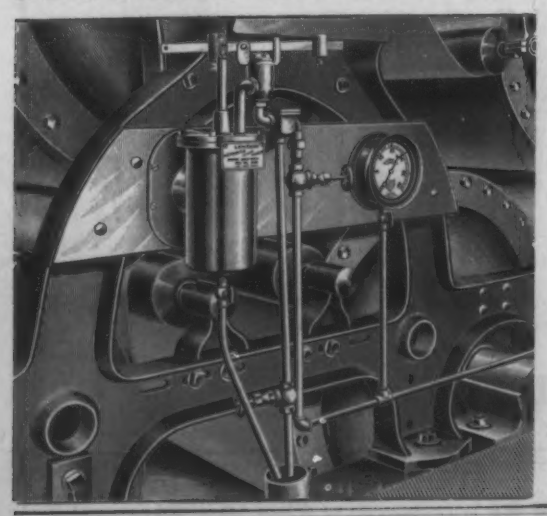

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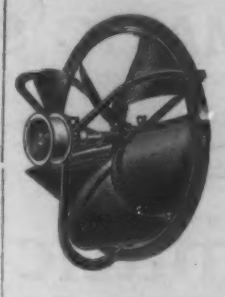

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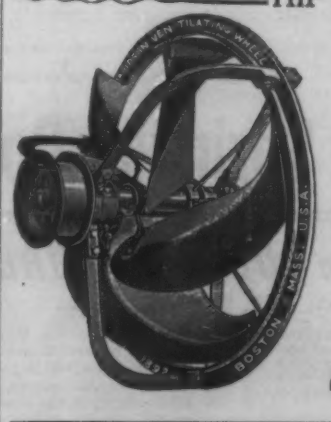

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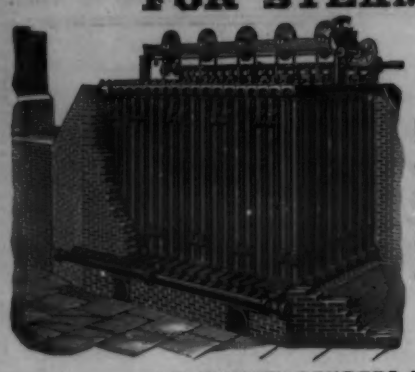

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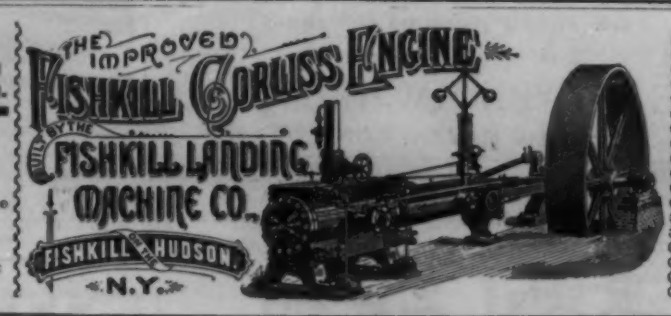

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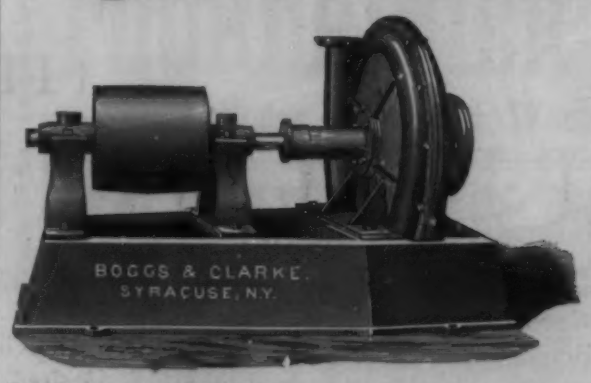

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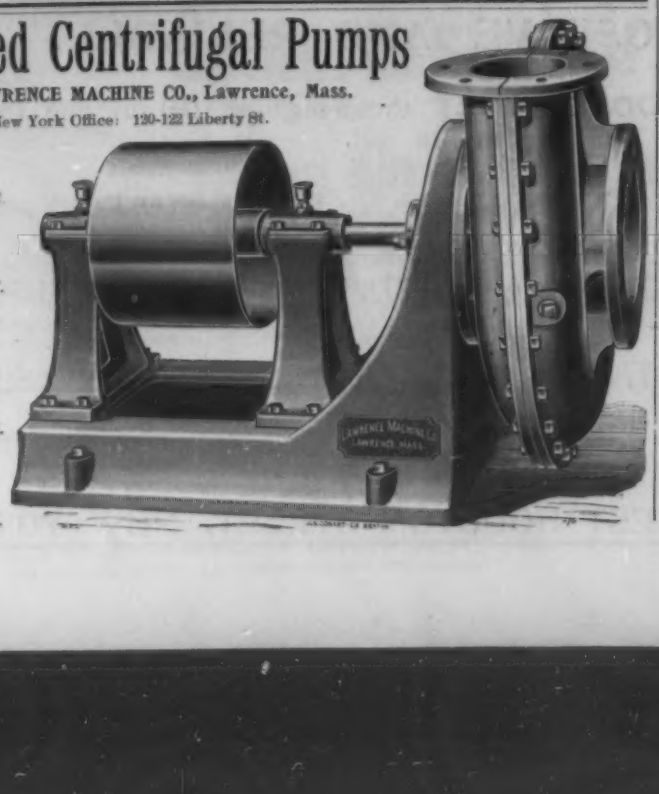

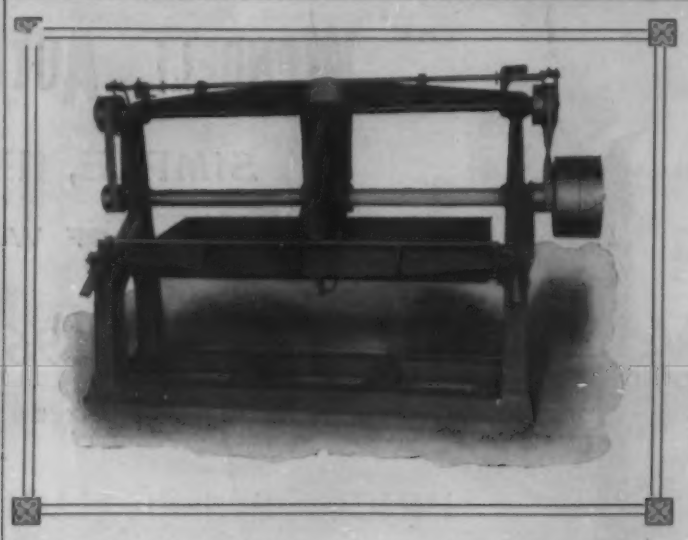

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Electricity in Paper Making.

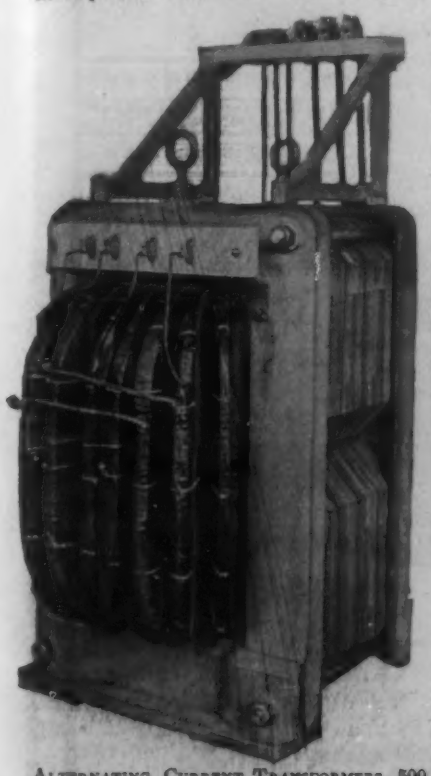
BY CHARLES F. SCOTT.

Nearly 1,000,000 horse-power is consumed in the manufacture of pulp and paper in the United States and Canada. Falling water and steam are the common sources of power. Both water and steam have functions other than the supply of power.

Water is used to a large extent in the making of pulp, so that a location where there is plenty of water at a good head is doubly inviting. Steam is used in paper machines for drying, often to so great an extent that the supplying of an engine to drive the machine is an insignificant addition.

At first sight there appears to be small opportunity for a new agent. Electricity, however, which has entered so many fields with transforming or revolutionizing effects, may reasonably be expected to contribute something to so extensive and varied an industry as paper making.

While it is true that electricity often reaches out into the mysterious and the miraculous, yet the functions which concern us are those which are well known and are definite—they are expressed in ordinary units, in pounds and speed and horse-power. But there should be no



ALTERNATING CURRENT TRANSFORMERS, 500 TO 15,000 VOLTS.

The ends of the vertical coils are spread apart to facilitate the circulation of the oil in which the transformer is placed.

need of allaying the prejudice against novelty of any kind in an association representing an industry in which in some lines the raw material has completely changed and the output has increased tenfold in twenty-five years.

The purpose of the present paper, which has been prepared at the request of your secretary, is to explain in a brief and simple manner some of the characteristics of electricity and electrical apparatus, and show in what way and under what conditions they may be made profitable in the paper-making industry. The principal topic is the application of electricity in supplying power.

ELECTRICITY AND POWER.

In an electric power system there are three distinct elements:

First—A dynamo or generator, which receives mechanical energy, derived from water power or from fuel, and transforms it into electrical energy. The dynamo does not create power; as if to repudiate the occasional assumption that it does it on the contrary always gives out less power than it receives.

Second—Conductors (usually copper wires) for transporting the energy to the place where it is to be used.

Third—A motor for transforming the energy of the electric current into mechanical energy in suitable amount and at proper speed for the work to be done.

The supply of power electrically may be considered under two heads: transmission and distribution; transmission applying to considerable distances and distribution to those cases where distances are short and the electric system is in competition with other methods of distributing power, such as shafting and belts, wire ropes or compressed air. There is, of course, some "transmission" involved in distribution, but the distances are so short that the conducting wires become of minor importance.

ELECTRIC TRANSMISSION.

General Principles—Electric energy is transmitted by a current under pressure. This has many close analogies to the transmitting of energy to a water wheel by the flow of water through pipes. The amount of power depends upon the quantity of flow and upon the pressure.

The hydraulic units are gallons per minute and feet of head. The electric units are amperes and volts. Gallons per minute multiplied by feet of head and divided by 3958 gives horse-power. Amperes multiplied by volts and divided by 746 gives horse-power. Amperes multiplied by volts gives watts; 1,000 volts is 1 kilowatt, or K. W.; a kilowatt is about 1 1-3 horse-power. Electric pressure is termed electro-motive force, or E. M. F., and corresponds to "head:" one is measured in volts, the other in feet.

When a current of water (or electricity) flows through a pipe (or wire) there is a loss in head (or E. M. F.), so that the pressure delivered in feet (or volts) is less than the initial pressure. This loss increases as the distance becomes longer, and it decreases if the diameter of the pipe (or wire) is made greater. If a given current is to be carried over twice the distance with the same loss in pressure the diameter must be increased, thus doubling the cost on account of the length, and again increasing it on account of greater size.

If a given current is delivered at twice the pressure, then the power delivered is twice as great. If the size or length of conductor is the same the loss in feet head (or volts E. M. F.) remains the same, but as the pressure delivered is now doubled the loss in per cent. is only one-half of what it was at the lower pressure. If the current be reduced to half when the pressure is doubled, then the same horse-power will be delivered; the loss in pressure, expressed in feet (or volts), is reduced to half, while the loss in pressure in per cent. is now only one-fourth as great. Doubling the pressure therefore reduces the percentage loss in transmission to one-fourth, the conductor and distance remaining the same. The conductor and distance may, however, be changed, and the same per cent. loss retained which existed before the pressure was increased. If the distance be doubled and the conductor made half its former size the per cent. loss will be unchanged; but as the length of conductor has been doubled and its size reduced to half, the cost of the conductor is also unchanged. It follows, therefore, that with a given cost of conductor and a given loss, the distance over which power can be transmitted depends upon the pressure. It has been assumed that when a conductor is reduced in size until its resistance is doubled the cost is reduced to one-half. This is true for the electrical conductors, although it is not accurately correct for the hydraulic conductor or water pipe.

The allowable limit of increase in pressure is a practical one; high pressures become difficult and dangerous to handle; a few thousand pounds (or volts) tends to break pipes (or insulation), and it is no simple matter to design water wheels (or motors) for receiving such pressures.

The ideal system, therefore, is one which combines a high pressure for transmission and a low pressure for the conductors and apparatus which are to be handled.

Alternating Current.—Power may be transmitted either by continuous flow in one direction, or by reciprocating or alternating flow. The former is comparatively simple; it is the ordinary flow in water pipes, and is the direct or continuous current in electricity. The alternating flow is not so simple and bears further consideration. If in one end of a pipe there is a piston which is moved back and forth, the water in the pipe has a reciprocating flow and will impart a similar motion to a piston in the other end of the pipe. This is analogous to the alternating current.

The alternating current is of great commercial importance, as its pressure can be transformed in a very simple and efficient way. Ten amperes of alternating current at 1,000 volts may be transformed into 100 amperes at 100 volts. By this means the power may be carried at the higher pressure over ten times the distance that it could be transmitted at the lower pressure without increasing the weight of the copper wire. If a still higher pressure be used, say 10,000 volts, then 1 ampere at 10,000 volts may be transformed into 100 amperes at 100 volts, enabling the transmission to be made over 100 times the distance that the power could be transmitted at 100 volts.

The apparatus by which this transformation is made is the alternating current transformer or converter. It consists of two windings, one connected to the high pressure circuit and the other to the low pressure circuit, which are placed together and surround a core of soft iron. The primary winding or coil receives current and magnetizes the iron. As the current reverses this magnetism also reverses, which induces a current in the other secondary coil in the same way that a current would be induced if the coil were placed on the armature of a dynamo and moved successively before field poles of positive and negative polarity. The transformer has no moving parts, requires no attendance, is automatic in regulation and efficient in operation. There is no mechanical connection between the two coils, which are separated by ample insulating material to protect the low tension circuits from the high pressure of the transmission line. Transformers are not only used for lowering from high to low pressure, but are frequently used for increasing the voltage of a low-pressure dynamo to a high E. M. F. for transmission.

Alternating currents have a mechanical analogue in the reciprocating motion of the piston of a steam engine. The piston is connected by a connecting rod to a crank on the engine shaft. Engines differ in the arrangement of cranks and cylinders. The single-crank engine corresponds to a single-phase current. A two-crank engine, with the cranks set at 90°, so that one piston is giving its maximum effect when the other is producing no effect, has its analogue in the two-phase (or one-half-phase) alternating current, in which there are two currents flowing in different circuits, one of which has its maximum value when the other is zero. A three-crank engine, with cranks set at 120°, in the same way corresponds to a three-phase alternating current, in which there are three currents conducted by three wires. The advantages of the engine with more than one crank in having no dead point and in uniformity of effort have corresponding advantages in the electric system. Polyphase currents are therefore commonly used for operating motors.

DIRECT-CURRENT APPARATUS.

Constant Current System.—Direct-current dynamos may be wound for delivering a constant current at a variable voltage. Such machines are commonly used for arc lighting. The lamps are connected in series so that the current passes successively through the different lamps and the E. M. F. required is proportional to the number of lamps in circuit. This system has been used to a limited extent for operating motors. The constant-current motor tends to vary in speed with variation in load and for maintaining constant speed requires a special regulator. The advantage of the constant-current machine is that it can be constructed for higher pressures than a machine wound for constant potential or pressure, and the system is therefore advantageous for transmission over long distances. The difficulties in speed regulation, the introduction of the high voltage current into motors, thus making it dangerous to handle the motor, and other difficulties in the details of the system have made it so far inferior to other kinds of apparatus that it has attained practically no commercial development in this country.

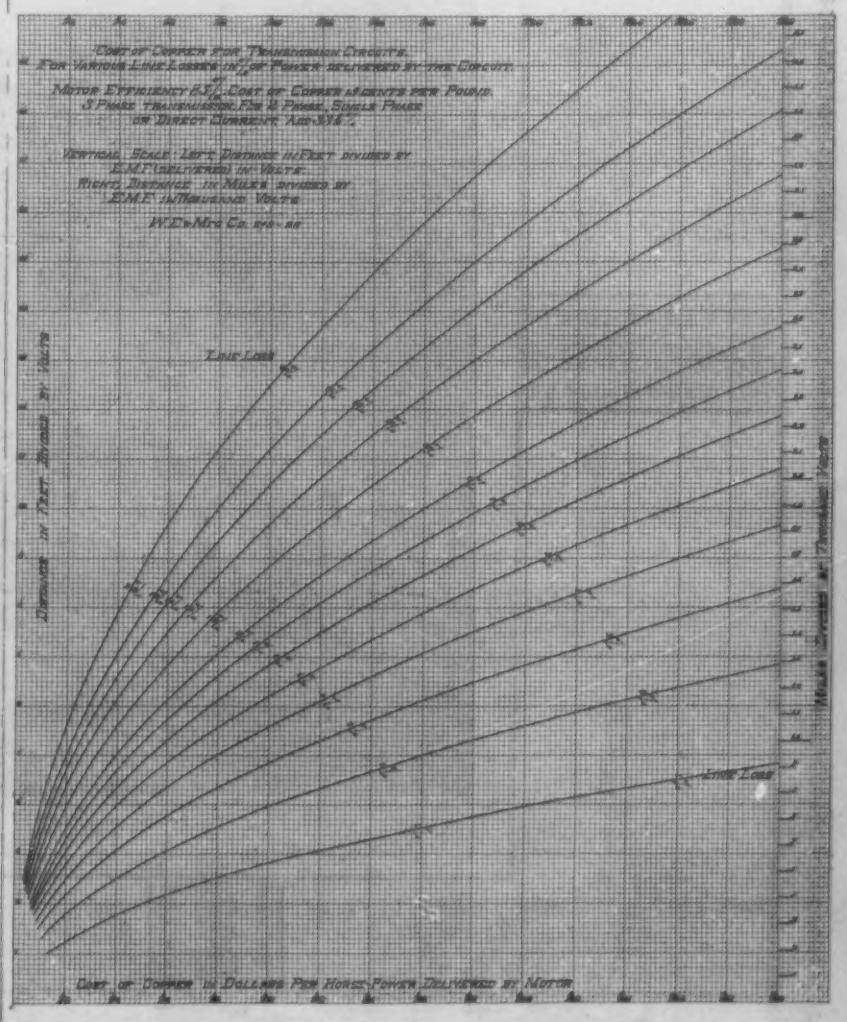
Constant Potential Generators.—Direct current generators are usually wound for a constant potential or pressure of 500 volts, 220 volts or 110 volts. The two higher voltages are common for power service; 220 volts is used where the distances are small, say not over a few thousand feet, and 500 volts is used for greater distances. The pressure between the two wires of the circuit is kept about constant, motors are connected directly between the wires and are said to be in parallel or in multiple.

Direct current generators are commonly of the multipolar type, having an outer field casting, with inwardly projecting poles which face a revolving armature, on one end of which is the commutator, from which the currents generated in the armature are received on carbon blocks or brushes resting on the commutator surface. Generators are either belt driven or direct connected. A direct connected machine either has its own shaft and bearings, and is joined by a coupling to the driving shaft, or it is of the "engine type," in which the armature is carried directly upon the driving shaft. The marked tendency during the past few years has been to discard the high speed belt driven generators for direct-connected machines at lower speed, the speed of the dynamo being usually adapted to that of the driving power. The present standard generators are of the "iron clad" type, i. e., the conductors are laid in slots or grooves in the surface of the armature. Projections or small teeth of the laminated iron core extend out beyond the windings and protect them. In most cases the armature winding is held in the grooves by wedges. There has been a marked evolution from the high speed dynamo of six or eight years ago, with its surface wound armature, having bands of fine wire for holding the winding in place and copper brushes which spark violently if they are not properly shifted and adjusted for changing loads. The modern machine with its substantial ironclad armature is practically sparkless from no load to a heavy overload without adjustment of the brushes, and is provided with self oiling bearings.

Constant Potential Motors.—Motors for constant potential circuits are series wound, shunt wound or compound wound.

A series-wound motor is adapted for variable speed work, such as is required in railway service. In the series motor the current passes through the field winding and the armature in series, so that the strength of the field varies as the current varies. If the load on a series motor is increased the speed falls and vice versa. The speed may be varied or controlled by introducing a resistance in series with the motor, thus reducing the pressure at the terminals of the motor. Resistances are ordinarily used in starting. A high resistance is first placed in series with the motor, which allows sufficient current to flow to start the motor with its load. As the speed increases the resistance is decreased until the desired conditions are reached. Reduction of the speed by introduction of resistance involves low efficiency. If there are two motors which are applied to the same work, as, for instance, in running a street car, it is common to secure low speed by connecting the two motors in series so that the same current passes through both motors and each receives half the E. M. F. of the circuit, and to connect them in parallel across the circuit so that each receives the full E. M. F. for running for speed. This enables the motors to run at about half speed with good efficiency.

Series motors are used for electric cars, cranes, elevators, and similar variable speed service which is under the control of an attendant, and also for pumps and similar service where the load is practically constant and a reduced speed is allowable or desirable if the load increases.


Cost of Copper for Transmission Circuits.
For Various Line Losses in % of Power delivered by the Circuit.
Motor Efficiency 87%. Cost per Copper Pounds per Pound.
3 Phase Transmission. For 2 Phase, Single Phase or Direct Current Add 33⅓%.
Vertical Scale. Line Distance in Feet divided by E.M.F. (Pressure) in Volts.
Right Distance in Miles divided by E.M.F. in Thousand Volts.
W.E. & Mfg. Co. 98-28
Line Loss
Line Loss
Line Loss
Distance in Feet
Miles
Cost of Copper in Dollars per Horse Power Delivered by Motor

CURVES SHOWING COST OF COPPER FOR TRANSMISSION CIRCUITS.

Series motors have the field winding connected directly across the circuit, and the armature connected directly across the circuit so that the currents flow in parallel and the armature current does not flow through the field as it does in the series motor. The shunt motor tends to run at a constant speed. The speed may be practically constant at all loads or it may fall a few per cent. between no load and full load, depending upon the design of the motor.

A resistance or rheostat is placed in series with the field circuit; adjustment of this resistance causes variation in the current through the field, which in turn produces a change in the speed of the motor. The speed may be varied to a greater or less extent, depending upon the individual motor, often as much as 10 per cent. or 15 per cent., and in some motors over a wider range.

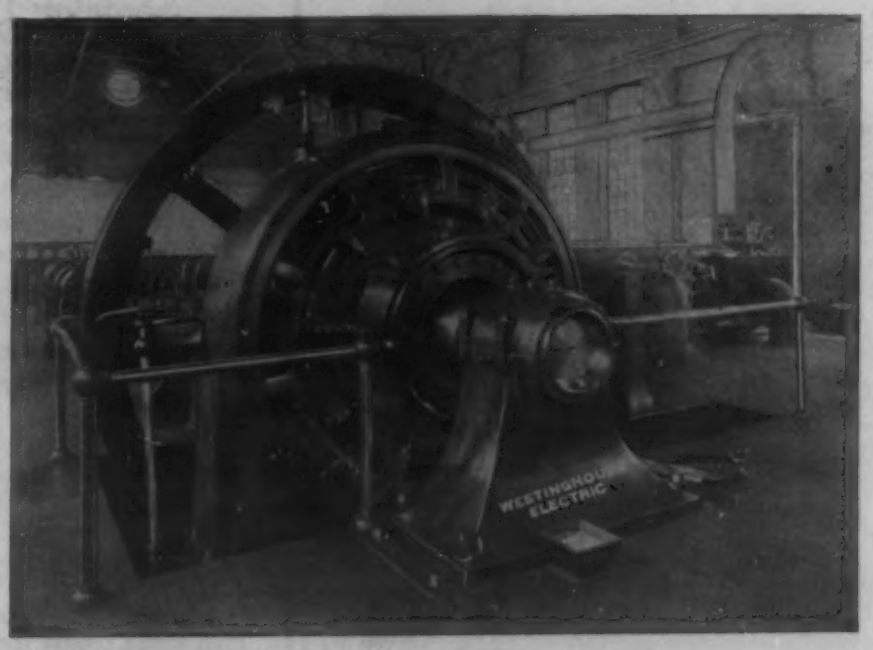
The speed depends both upon the field current and upon the voltage on the armature. If the field current is constant the speed may therefore be reduced by lowering the pressure on the armature, either by inserting in the armature circuit a resistance or by connection to a circuit of low voltage.

When the pressure is reduced by "throttling" the current by means of a resistance the speed is unstable—it varies as the load varies—and the efficiency is reduced owing to the loss of power in the resistance. If the speed is reduced one-third then one-third of the power received is wasted. A rheostat or starting box is, however, useful in starting, as it introduces a resistance which prevents the initial rush of current which would otherwise occur. The resistance is cut out as the motor attains its speed. When a low pressure is obtained from a low voltage circuit the motor runs efficiently at a low speed.

Compound-wound motors have two windings upon the field; one is a shunt winding connected directly across the circuit, the other is a series winding and carries the armature current. The strength of the field is therefore determined by the shunt current, which is constant, and the series current, which varies with the load.

The compound motor usually has the two windings connected so that the series winding increases the magnetization produced by the shunt winding. In this case the speed falls as the load increases. This motor is therefore intermediate in its characteristics between the shunt motor, which has practically constant speed, and the series motor, which varies greatly in speed with different loads. The compound motor is adapted to work in which there is liability to heavy overloads and where close speed regulation is not important. It is especially adapted for elevators, hoists and for running grinders or other heavy machines which run at fairly constant speed.

Construction of Motors.—The present standard type of direct current motor consists of a multipolar field having four or more poles with coils on all of the fields and a slotted armature with coils laid in the slots. The commutator is supplied with carbon brushes and there is practically no sparking under normal conditions and no injurious sparking with momentary overloads. The machines are simple and substantial in construction and are either built with an open framework or enclosed in a casing or housing for protection against dust, dirt and water.



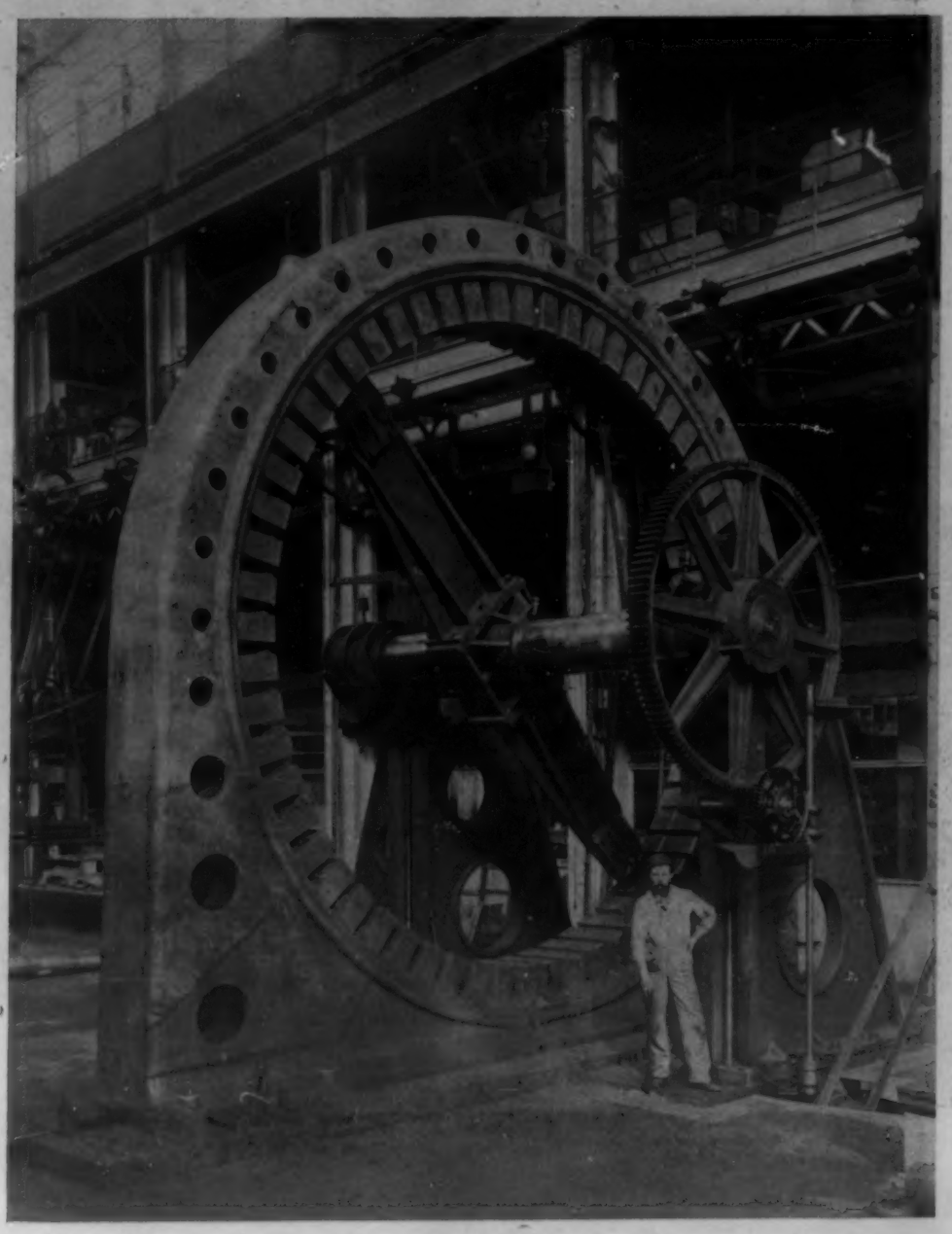
AN ENGINE-TYPE DIRECT CURRENT GENERATOR SUPPLYING POWER TO MOTORS AT A BLAST FURNACE.

ALTERNATING-CURRENT APPARATUS.

Voltage, Phases, Frequency.—Alternating current generators are commonly wound for 220 volts, 440 volts, 1,100 volts, 2,200 volts or a higher E. M. F., in general not exceeding 6,000 or 10,000 volts. Alternating current motors are usually run at the lower voltages. Large sizes are wound for 1,000 volts or 2,000 volts. If the distance between generator and motors is not sufficient to require a high voltage for transmission, the current passes directly from generator to motors. If the distance is considerable the generator may supply the transmission line directly at several thousand

Westinghouse manufactures everything Electric--from the most delicate Measuring Instruments to 5000 H. P. Generators.

MAIN AISLE OF WORKS.



2000 H. P. GENERATOR.

BENEATH THIS AMPLE ROOF.....

are to be found Electrical Machines of the

Greatest Variety
Greatest Capacity
Most Perfect Design

The name of WESTINGHOUSE is a guarantee.

Westinghouse Electric Machines.

Some of Those Under Construction:

15-5000 H. P. Generators, St. Lawrence Construction Co.
5-5000 H. P. Generators, Niagara Falls Power Co.
These machines have twice the capacity of the Largest ever made elsewhere.
4-500 H. P. Polyphase Induction Motors.
They are the Largest Induction Motors in the World.
4-2000 H. P. Generators, Allegheny County Light Co., Pittsburgh, Pa.
4-2000 H. P. Generators, Philadelphia Traction Co.
2-650 K. W. Generators, Utah Power Co.
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Should we use Electricity?

"I believe it would be economy for any new Paper Mill to equip itself with a central station for the development of its power electrically, and distribute it through the whole plant by Motors."

"Our experience with ELECTRICAL Power has been even more satisfactory than we had hoped for."—HON. ARTHUR C. HASTINGS, The Paper Trade Journal's 25th Anniversary Edition.

Westinghouse Electric and Mfg. Co.,

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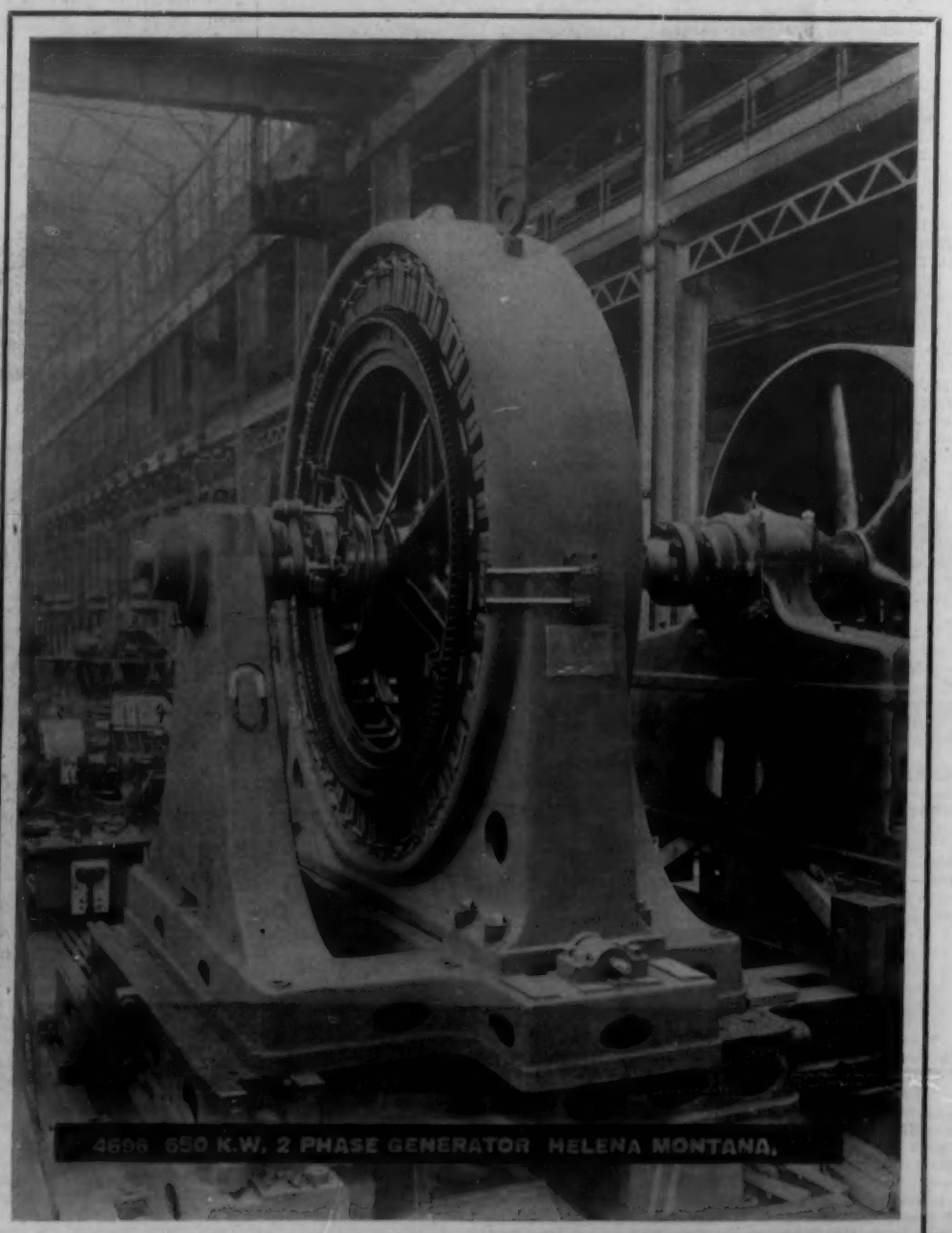


Westinghouse Generators and Motors for Mills and Factories

are the only kind that possess Ideal Simplicity of Construction and Operation.

That is why

The San Rafael Paper Mills, Mexico, were obliged to increase their former Electrical Apparatus by

3 Westinghouse Generators, 1,500 H. P.
5 Westinghouse Motors, 805 H. P.

And that is why

The Cumberland Paper Mills, Portland, Maine, were obliged to increase their former Electrical Apparatus by

4 Westinghouse Generators, 800 H. P.
7 Westinghouse Motors, 475 H. P.
8 Westinghouse Transformers, 1,332 H. P.

"Lord Kelvin seems to have been particularly impressed with all that he saw in the great yards of the Westinghouse Company."

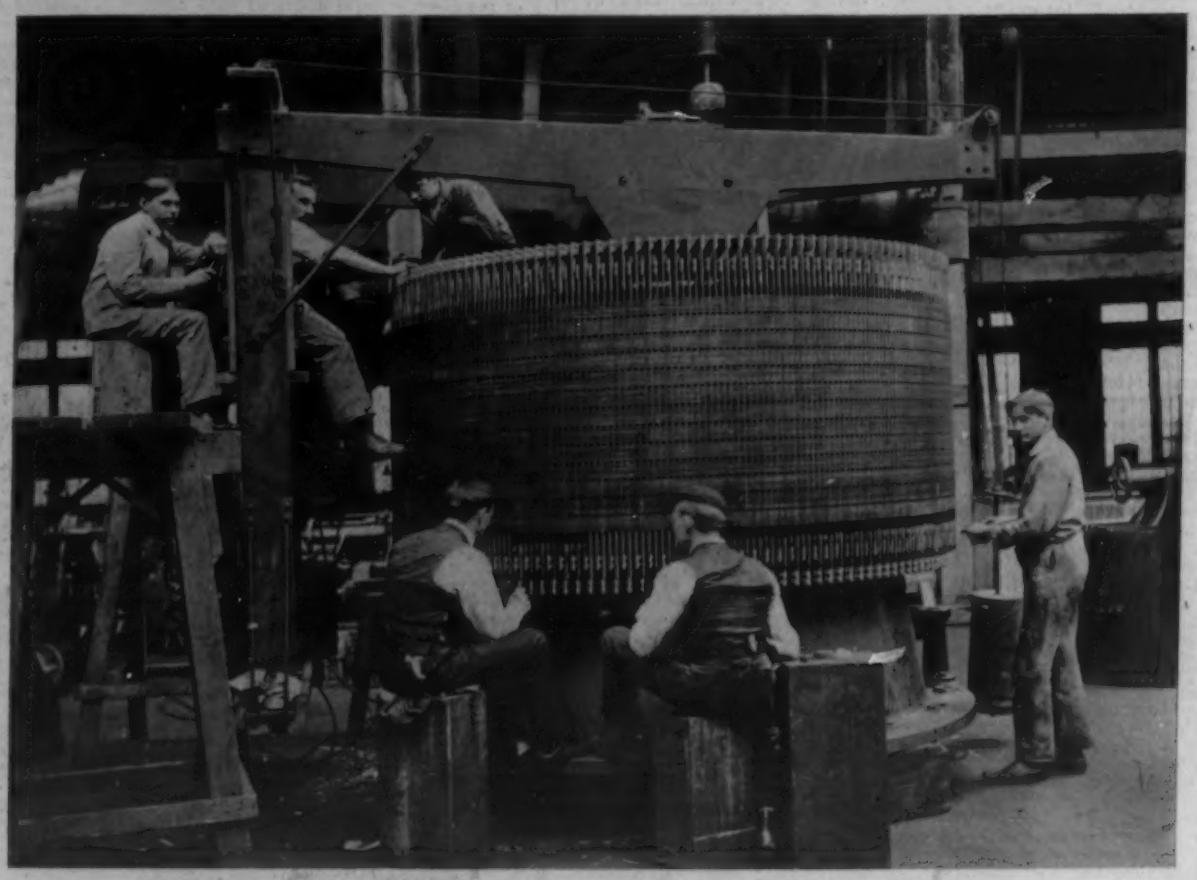
Holland's interview with Lord Kelvin, Philadelphia Press of Sept. 19, 1897.

The Westinghouse Electric Works:

Cover 12 Acres.
Employ 4000 persons.
Operate 1350 Machine Tools that are Entirely Electrically Driven.

Here the largest Electrical Contracts ever projected have been carried out.

Said by Foreign visitors to be the most Perfect Works in the World for the manufacture of Electrical Apparatus.



WINDING THE ARMATURE OF A 5,000 H. P. NIAGARA GENERATOR.

BRANCH OFFICES:

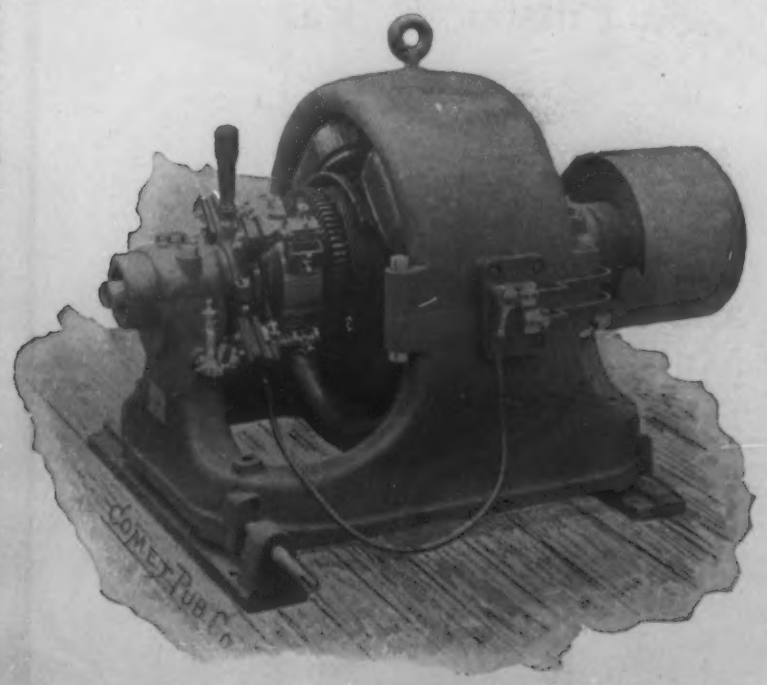
Pittsburgh, Pa., New York, Boston, Chicago, Philadelphia, St. Louis, San Francisco, Buffalo, Syracuse, Atlanta, Tacoma. Mountain Electric Co, Denver. For Canada, Ahearn & Soper, Ottawa. Westinghouse Electric Co., Ltd., 32 Victoria St., London.

The name of WESTINGHOUSE is a guarantee.

The crowning glory of 19th Century Engineering Skill is the transmission of the power of Niagara Falls by Westinghouse Generators.

"I feel safe in saying that there are no machines which so perfectly perform the work for which they were established." LORD KELVIN.

volts and the pressure may be reduced by transformers to that required for the distribution circuits. For a very considerable distance the generator may be wound for a low voltage and raising transformers used for delivering a high E. M. F. to the line. Numerous plants are in operation at 10,000 and 15,000 volts, others at 20,000, and installations are being made for higher voltages. In general an E. M. F. of about 1,000 volts per mile gives a cost of copper which is small in proportion to the other elements of a plant. The cost is not excessive when the distance is two miles per 1,000 volts, but the cost of copper soon be-



A Standard 80-H.-P. Direct Current Multipolar Motor.

comes prohibitive if the distance is much greater than this.

Alternating current power apparatus is adapted for two-phase or for three-phase currents. The advantage of three-phase currents is in the reduced number of wires, which both secures mechanical simplicity and also reduces the amount of copper. At a given voltage three wires will carry a three-phase current with the same loss that four wires, involving an increase of one-third in weight, will transmit a two-phase current. The two-phase system, however, has certain advantages where the loading is single-phase loading, such as incandescent lighting. If the phases are loaded separately the circuits are more nearly independent and the regulation of pressure is more simple and satisfactory when the two-phase system is used. The advantages of both systems are secured by a method of connecting raising or lowering transformers, by which three-phase currents may be used for transmission, derived from either a two-phase or three-phase generator and transformed into two-phase currents for the distributing circuits.

The frequency of alternating current is determined by the number of poles in the generator and the speed. If, for example, there are twelve poles and the speed is 600 revolutions per minute, there are 7,200 alternations of current per minute. If the number of poles is twice as great, or twenty-four, and the speed is reduced to one-half, or 300, the number of alternations is the same. This is expressed either as alternations per minute or as cycles (each consisting of two alternations) per second. Seventy-two hundred alternations per minute is sixty cycles per second; 16,000 alternations was formerly used for alternating current incandescent lighting; 7,200 alternations is now the common frequency for supplying both light and power. Three thousand or 3,600 alternations is often used where the service is principally power and the lighting is insignificant. Power work frequently has its own characteristics which sometimes render one and sometimes the other best adapted to specific conditions. Where specially low speeds are demanded, the lower frequency is preferable.

Generators—Commercial alternating current generators are usually similar in type to direct current machines, except that they have a greater number of poles. Like direct current machines, they are either belt-driven or direct connected; the armature is "iron clad," and the construction is in a general way similar to a direct current machine, except that the windings are connected to collecting rings, from which the current is taken by brushes which rest continuously upon the same ring, instead of having the windings connected to a commutator on which the brushes make connection to successive bars which are connected with the winding.

The alternating current generator is simple and substantial in construction; there are no moving parts except the revolving armature, and no points of wear except in the self-oiling bearings and simple copper brushes bearing against contact rings.

There are two special types of generators, the revolving field type and the inductor type. The revolving field type is similar to the standard form above described, except that the field and armature change places—the machine is turned inside out. The field poles revolve, and the armature windings are placed on the inside surface of the surrounding cylindrical frame. Exciting coils are placed on the several poles. In the inductor type the field winding consists of a single coil, which is stationary. This is a modification of the revolving field machine, secured by the omission of alternate field poles. This naturally reduces the capacity of the machine, either impairing its performance or requiring additional size and weight for securing results equal to those of ordinary machines. The particular advantage gained in these special forms is that the winding in which the main currents are generated is stationary. This facilitates insulation, so that these machines can be wound for higher voltages than the standard type with revolving armature. Some advantage is also gained in having no collector rings for the main current, and also in the inductor type no collector rings for the exciting current.

The Niagara 5,000 horse-power generators have a revolving field outside of a stationary current. They are like the standard type of machine, except that the shaft is vertical, and the field, instead of the armature, revolves.

Motors—Alternating current polyphase motors are of two types, the synchronous motor and the induction motor.

Synchronous motors are similar in general to alternating current generators; there are field magnets which are magnetized by a direct current, and the general construction of the machine is similar to that of the generator. In fact the same machine is often used to perform the double function sometimes of motor and sometimes of generator. The speed of the synchronous motor bears an exactly definite ratio to that of the generator which drives it, independent of the load upon the motor. If the maximum capacity of the motor is exceeded it will stop; it has little torque at low speeds, and must be started either without load, and often a separate motor is used for starting it. Direct current must be provided, usually from a separate machine, for exciting the fields. It is much better adapted for large powers than for small sizes in miscellaneous work.

In the induction motor the currents in one element are not obtained from any external source, but are induced or generated wholly within its own winding, very similar to the currents induced in the secondary of a transformer. When this introduced or secondary element rotates there need be no brushes nor electrical connection with the windings. The wires from the circuit are connected to the wires in the outer or stationary element, so that there need be no open or moving contact of any kind in connection with the motor. This describes the motor in its simplest form. There are modifications sometimes; the primary element revolves and the currents are introduced by brushes resting on rings, and sometimes the revolving element has windings and resistances which are adjustable either by hand or automatically. These modifications sacrifice some of the elements of a simplicity which is of especial value in many kinds of work.

The induction motor tends to run at the same speed as a synchronous motor, which has the same number of poles, but there is a slight falling off in speed, or "slip," which increases as the motor is loaded. The speed variation of the induction motor between no load and full load varies with the size and design of the motor, but does not exceed a few per cent.

The synchronous motor receives power from the circuit very much as a shaft receives power through gearing. The speed is absolutely and rigidly fixed by the driving power. On the other hand, the action of the induction motor is like that of a pulley driven by a belt; there is flexibility, slip. A heavy load does not break any gear teeth nor throw the motor out of step; there is simply greater slip and there is nothing to be feared until belt or motor begins to smoke.

The constant speed induction motor above described has an overload capacity of several times the full load torque. It is started either by connecting it directly to the circuit, which gives a starting torque considerably greater than the full load torque, or it may have a low E. M. F. applied for starting with a reduced torque and a reduction in the current required for starting. Ordinarily, the motor is provided with a double-throw switch, which is thrown in one position for starting and in the other position for running.

The induction motor may have a special winding by which either of two numbers of poles may be secured. For example, a 3,600-alternation motor may have either four poles, giving a speed of 900 revolutions per minute, or six poles, giving 600 revolutions, or a motor may have either four poles or eight poles, giving 900 or 450 revolutions. This modification adds something to the cost of the motor.

The induction motor is also made for variable speeds. When running without load the motor runs at the same speed that the corresponding constant speed motor would run, but as it is loaded the speed falls rapidly. The motor starts with greater torque than the constant speed motor. It may be provided with a regulator, by which the E. M. F. applied can be varied so that over a wide range the motor can deliver any torque at any speed. This motor is used for cranes, hoists, elevators and similar work where large starting torques, frequent starting or variable speed is required.

The description of the induction motor from a mechanical point of view is a negative one—it has no commutator, no collecting rings, no brushes; there is nothing to handle but the switch, and it may be at any distance from the motor, nothing to wear but self-oiling bearings; there are no exposed parts, and there is no sparking and no danger from fire. The alternating current with its profound and intricate theoretical properties, and polyphase currents with their somewhat confusing relations and reactions, have produced a motor of almost ideal simplicity.

Rotaries.—The rotary transformer or converter is a machine by which alternating current may be transformed into direct current. The machine performs the double function of an alternating current, synchronous motor and a direct-current generator. A single armature winding is connected to collecting rings for receiving alternating current and to a commutator for delivering direct current. This type of machine is attaining a considerable commercial importance for combining into one plant the alternating current and the direct current. The alternating current is used because it can be transmitted at high pressures cheaply and because the alternating-current motor is so simple mechanically. The direct current is often required where the alternating current is inapplicable, as for the running of street railways or charging storage batteries and electrolytic work. The voltage of the direct current delivered by a rotary may be adjusted by varying the alternating voltage by which it is supplied. This may be efficiently done by varying the ratio of the turns in the lowering transformers.

EFFICIENCY OF ELECTRICAL APPARATUS.

The full load efficiency of generators, both of direct current and alternating current, varies with the size and type, but for machines of 100 horse-power and over the variation may be from 90 or 91 per cent. to 95 or 96 per cent.

The efficiency of alternating-current motors of two types, the synchronous motor and the induction motor.

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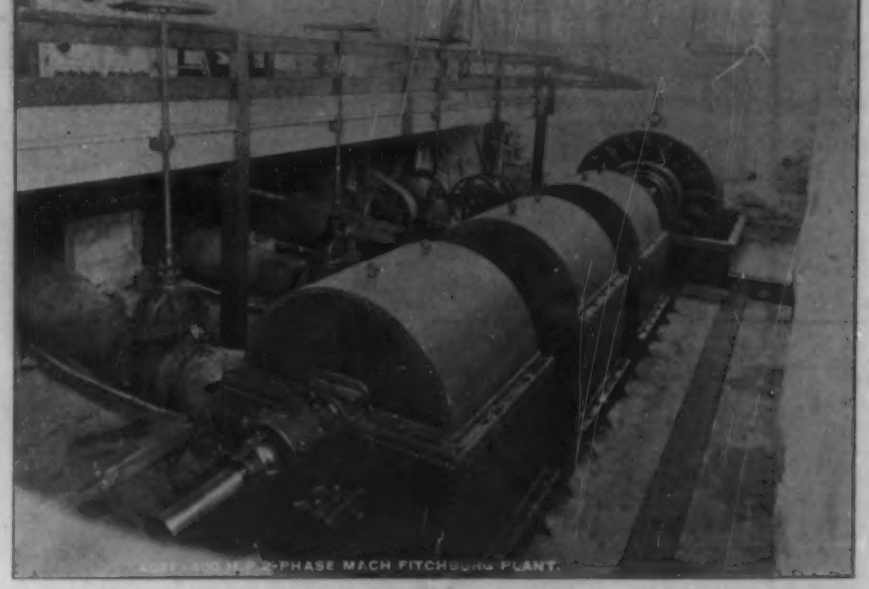
The efficiency of alternating-current



400-H.-P. Alternator Operating Five Induction Motors, 7½ to 250-H.-P., for Operating a Saw Factory.

transformers, in the same way, may be said to vary from 96 or 97 per cent. in sizes less than 100 horse-power and 97 or 98 per cent. in larger sizes.

The efficiency of motors, both for direct current and alternating current, varies from 80 or 85 per cent. to 90 per cent. in sizes from 5 to 100 horse-power, and is 90 per cent. to 96 per cent. for larger sizes.

Efficiency of transmission lines and distributing circuits depends upon the E. M. F., the amount of copper and upon the cost.

The approximate efficiency of a transmission plant will therefore be between limits about as follows:

Generators	90	to	96
Raising transformers	96	"	98
Transmission line	90	"	95
Lowering transformers	96	"	98
Local wiring	97	"	99
Motors	85	"	96
Efficiency of plant	61	"	83

In local distribution from low voltage generators the losses in raising and lowering transformers are of course eliminated, and the range of efficiency becomes 66 per cent. to 86 per cent.

POWER IN PULP AND PAPER MANUFACTURE.

In a general way the special requirement for power to be used in making and handling pulp is quantity, and in manufacturing paper is quality; that is to say, large quantities of power are used in one case with no special requirement as to speed or regulation, while a comparatively small amount of power is required for driving paper machines, which are very exacting in their speed requirements and regulation.

The machine which cuts the rags in the preparation of rag stock, the slowly rotating boiler in which the rags are cooked, the sawing, barking and cutting wood into chips, the driving of revolving stones, are all operations performed in different processes of paper making which can evidently be operated by electric motors. The quantities of power required vary from a few horse-power to several hundred horse-power, and there are no exacting requirements as to variation in speed; there is therefore nothing novel nor peculiar in the application of electricity to such work.

In the paper mill proper power is used from start to finish, and in the larger and best arranged mills must be distributed over

A Direct Current Motor—Dust and Moisture Proof Type. Access to Commutator is Afforded by Opening the Lid at End of Motor.

a very considerable area, which requires in general heavy shafting, many gears and much belting. Some parts of the work, such as the beating engine, the pumps, the screens or strainers which are to be continually agitated, are very similar to the operations already referred to, in which all that is required of the driving power is a fairly constant speed. The general characteristics and advantages in the use of motors will be considered presently.

A paper machine on the other hand contains, in addition to certain parts which run always at approximately constant speed, a half dozen or more parts which must run harmoniously, and their speed throughout must be capable of variation over a wide range, so that they can be adjusted to run regularly and constantly at a certain maximum speed or at any desired speed down to about 30 or 40 per cent. of the maximum speed. The speed is determined by the thickness of the paper which is to be produced. The speed is not subject to frequent change and the change can be made deliberately. Again, the different integral parts of the paper machine do not run at exactly the same speed, but a higher speed must be given to the final part of the machine, as the paper elongates as it passes through the machine. This difference in speed must moreover be adjustable from time to time.

Usually a main driving shaft at constant speed supplies the power through adjustable gearing or cone pulleys. The cone pulleys admit of very fine gradations in the speed ratio. Some objections to this method are loss of power in the gearing, bearings and belts, the amount of room which they occupy and the cost and liability to accident in so extended an amount of machinery. On the other hand, the aggregate power used by a paper machine is not large, so that the actual loss in power in the machinery is not excessive. The cost is not great in comparison with the total cost of the machine, and the machinery is all of a comparatively simple sort, which can be easily cared for.

A paper machine may be driven by an electric motor which operates the main driving shaft. The ideal method, however, is probably the application of electric motors attached directly to each part of the machine, so as to avoid all external shafting, gearing and belting. While it is theoretically possible to do this and to have motors so nicely adjustable as to give the requisite relative speeds to the different parts of the machine and to enable the speed of the whole machine to be adjusted over wide limits, yet after a careful consideration of the subject this does not appear to be feasible and practicable. The condition of running regularly at any speed over a wide range and with such precision that a number of motors differing in speed less than 1 per cent. shall not have an appreciable variation in their relative speeds is one so exacting that it cannot be obtained reliably and efficiently at any reasonable cost.

It is not feasible therefore to drive those individual parts of a machine which are to run at different speeds by separate motors. When all of these parts are driven from one shaft, the variable speed of this shaft can be secured either through mechanical means or by varying the speed of the motor by which it may be driven.

The commercial standard direct current motors for constant potential circuits admit of only a slight variation in speed, usually not more than 10 or 15 per cent., by adjustment of the field current of the motor. There are, however, several methods by which a motor can be made to run constantly at any speed over a wide range. Alternating current motors also admit of certain variations in speed when suitably designed. The methods by which these variations can be obtained are too varied and technical to permit of elaboration in the present article. A general characteristic of all these methods of speed control is that they require special apparatus, and while the cost above that required for a constant speed motor will in many cases necessitate a choice of variable reduction by mechanical means, yet there may be other causes where the avoidance of mechanical complication will amply justify the electrical equipment for speed control. The electrical method of control for a given case must be determined by the range in speed and the horse-power which are required and the relative facility with which the several methods may be used in connection with the other kinds of work for which the electrical plant is to be installed.

ELECTRIC PLANT AT CUMBERLAND MILLS.

S. D. Warren & Co.'s plant for the production of high grade book paper is located at Cumberland Mills, about 4 miles from Portland, Me. The mill is a large one, covering many acres of ground, and is noted for the progressive and intelligent methods employed in its management. Some 5 miles below the mill on the Presumpscot River is a water power, having some 10 feet fall with about 1,500 available horse-power. At this point machinery is placed for the transmission of power back to the mill. The following brief description of the plant has, in the main, been obtained through the courtesy of Messrs. Stone & Webster, engineers, under whom the plant was constructed.

At the station are two 300 horse-power two-phase Westinghouse generators, each driven by two 48-inch Victor vertical wheels. The generators are operated in multiple and supply a current at 1,100 volts to four 200 horse-power step-up transformers, which deliver the current at 8,000 volts to a three-phase line of bare copper wire by which the power is carried 4 miles to the mill, where the pressure is reduced by four 133 horse-power step-down transformers to 400 volts for supplying two-phase motors, and an additional transformer of the same size supplies current for lighting. There are seven two-phase Westinghouse induction motors; four 50 horse-power motors and a 75 horse-power motor are used to drive pumps and other machinery, and each of two 100 horse-power motors is direct coupled to a 100 horse-power direct current generator which furnishes

current at 110 volts for electrolytic purposes. (Rotaries could now be used for this work, but were not available when the plant was installed.)

This plant drives machinery in the pulp mill consisting of the chip conveyor, chip rammers, the rotaries, the pulp screen, extractors and pumps, all the machinery in the caustic and chlorine rooms, and the elevator in the screen rooms. In addition to this the power is also used for an electrolytic process, and arrangements have been made so that the entire mill lighting can be taken from this system if desired, but ordinarily this lighting work is done by a separate plant. Practically all the machinery runs at a constant speed; most of it operates twenty-four hours per day and six days in the week, an extremely desirable condition, both for electric plants and power transmission.

In addition to the transmission plant just described there is also a direct current transmission of about 250 horse-power from Mather generators, at 500 volts, from a station about a mile up the stream from the mill. This plant was installed prior to the polyphase plant and drives various machinery in the sorting house, and has been used for operating the calenders. All the motors in both systems are belted to short lines of shafting or directly to their work. The standard speeds of belted motors have been found satisfactory. In certain parts of the mill the motors are necessarily exposed to chlorine gas, so that the least possible exposure of brass work or other metal subject to corrosion by these fumes is desirable. The polyphase motors installed about two years ago have not suffered interruption or damage from this source and seem to be entirely satisfactory for the work. It is a serious question whether direct current motors with their exposed commutators, brush holders, etc., would stand this service satisfactorily. In some parts of the mill there is considerable dampness, but this has not been so excessive as to require water proof or enclosed motors. The pulp pumps are sometimes jammed and absolutely stopped by pieces of wood which get into the pump cylinders. This necessarily stops the motor, and the characteristics of the alternating current motors are extremely valuable, as this sudden stoppage does no harm whatever. A direct current motor if placed in circuit and treated in the same way will be seriously injured, if not burned out, by the very heavy current and the violent sparking which would occur.

Tests at this plant show an efficiency of 76 or 77 per cent.; that is, for every 100 horse-power mechanical output of the turbines the motors deliver 76 or 77 horse-power to the machinery at the mill. The tests of the power consumed in the pulp mill, before its operation by steam was abandoned and again after the electrical plant had been installed, show a marked and very gratifying saving in the amount of power used, resulting from the more direct application of the power to the machinery and the elimination of the dead load of long shafting, bevelled gears and belts.

It has been found advantageous to divide the motors used into many small units, thereby securing independent control of the different classes of work as well as saving considerable power which would otherwise be lost in long shafting, cross belts, bevelled gears, etc. Induction motors appear to be better adapted for the work than synchronous motors, although the infrequent stoppage of such parts of the work as the electrolytic processs, for example, would make their use permissible.

The experience at this mill justifies the conclusions:

First, that the requirements of pulp and paper mill service present a large field for the introduction of electric motors and electric transmission, with opportunity for ample economies in operation and improvement in service, and

Second, that the polyphase alternating current apparatus is in general better adapted to the requirements than is direct current apparatus, owing largely to the flexibility of the alternating system, the simplicity of the alternating current motor and its ability to stand acid fumes, dampness, the severe strains of sudden stoppage and long continued service.

Mr. John E. Warren, of the Cumberland Mills, writes regarding the alternating plant: "This equipment has worked in a very satisfactory manner. It is not entirely free from objections, but has given us little trouble and worked as uninterruptedly as a steam plant could have done, and we would not hesitate to enlarge or duplicate the apparatus if occasion should require. * * * One convenience we have found is the use of electric motors as dynamometers. Wishing to determine the amount of power required to drive machinery or groups of machinery we have frequently set up an electric motor and measured the current required to do the work. Our endeavor has been to use electric power for twenty-four hours' service, as under these conditions it will often be found profitable to use it where steam power would be cheaper for ten hours' service. The matter of regulation has been a difficult one, but not insurmountable, and the electric power that we are now using is now very satisfactory."

SAN RAFAEL PAPER MILLS, MEXICO.

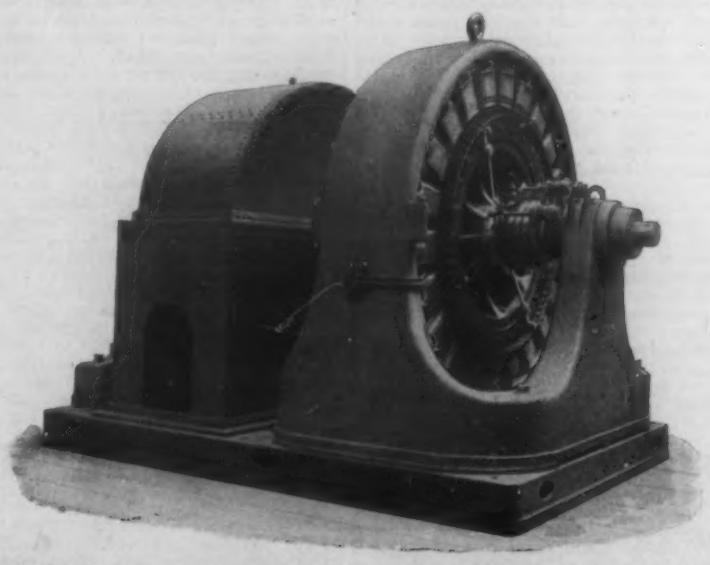
The mills named are located near Tlalmanalso, district of Chalco. The following data regarding driving of the mills have been furnished by Mr. A. Woern, engineer of the company.

At present the mills are supplied with seventeen Pelton type wheels directly connected to their work. This power is augmented by electric power by apparatus of the General Electric Company. A 480 horse-power generator driven by Pelton wheel at 600 revolutions supplies three-phase current at 3,200 volts from a distance of a mile and a half to a 400 horse-power synchronous motor at 200 revolutions, which drives two New England grinders and accessory machines for wood grinding. This electric plant has been in satisfactory service for about a year.

In the future changes will be made, for which apparatus is now under contract and construction. The former generator is to be replaced by two 500 horse-power Westinghouse generators, running at 212 revolutions, and a duplicate generator will be placed at a little over a mile from the mill at another water power. The former generator will not be used, as it is desired to make the plant uniform, having all generators at a lower speed. The former motor will be continued in service, supplied from the new generators, and Westinghouse induction motors will be added.

A 500 horse-power motor will drive at one end two new pulp grinders made by Olin Scott, Burlington, Vt., and at the other end five beating engines of 1,000 pounds from Zurich, Switzerland.

A 200 horse-power motor will drive a paper machine made by the Pusey & Jones



1,000 H.-P. Alternator and Pelton Wheel. Total Height, 11 Feet 7½ Inches. Speed, 327 R. P. M.

Company, Wilmington, Del. This machine is 132 inches wide and has 28 dryers. The speed of the paper can be varied from 25 to 400 feet per minute, various speeds being attained by the cone pulleys and introduction of trains of gears from the standard motor speed.

Miscellaneous smaller motors will be used; 50 horse-power for supercalender, 50 horse-power for sulphite mill, 30 horse-power for shop and 25 horse-power for fan pump, etc.

It is notable that both this plant and that at Cumberland Mills have increased from small electric plants to larger ones, and that in both cases the new equipment is the alternating current system using induction motors.

CLIFF PAPER COMPANY, NIAGARA FALLS.

The electrical equipment at the mill of the company named consists of:

Two 150 horse-power compound-wound 500 volt direct-current generators directly connected to 300 horse-power turbines located at the foot of the cliff on same level with pulp grinders. The current is carried up the cliff to the motors, a distance of about 400 feet.

Two 125 horse-power compound-wound 500 volt motors operating shafting for two 102-inch paper machines. Several smaller motors are also in use where it would be inconvenient or expensive to run belts or shafting.

Hon. Arthur C. Hastings, general manager of the company, in an article upon electric power in the operating of paper machines, in THE PAPER TRADE JOURNAL, October 16, 1897, refers to the operation of the plant as follows:

"Our experience with this power has been even more satisfactory than we had hoped for. We are getting very steady speed on the paper machines, the motors never checking, and the cost of attendance being nominal. While the generators and motors are some 400 feet apart, the only means of connection between them being an incline elevator, one man attends to both generators and motors and does whatever is necessary in the way of wiring or attending to our lighting circuits. The cost of oil for lubrication is not one-twentieth of what it was with steam engines, and the saving of coal is at least 50 per cent.

"The governing of the water wheel, of course, has a great deal to do with the steadiness with which the motors are run, although a variation of 5 per cent. of the speed of the water wheel does not give over 2½ per cent. variation on the motor, through the compound winding.

"I believe it would be economy for any new mill to equip itself with a central station for the development of its power electrically and distribute it through the whole plant by motors, thereby saving putting in shafting and belts, and ofttimes losing power through running a great deal of useless shafting, besides saving in other ways, such as oil, fuel and attendance.

"Another point of great importance to any user of power is the ability to tell where he is using the greatest amount of power in his mill * * * With steam engines or water wheels it is practically impossible to get at the exact amount of power taken at each point, but with the instruments used with electric power one can determine just where he is using power and where it can be saved. In our own case we have been able to regulate the power to the exact amount required to run a certain size machine, as we have found shafting out of line, tight bearings, etc., by experimenting, that is, running different parts of the machine separately, at different times.

"The use of electric power is no experiment, as shown by the development and use at present of about 25,000 horse-power by two power companies in Niagara Falls."

Mr. Hastings has contributed for incorporation in the present article the following suggestions relating to some things which could be improved upon in the system which he now has:

"First, to have a controller so that a change in speed by its regulator could be made on the paper machine without changing any belts. This would be a great advantage at times in running different weights of paper where we would like to change the speed, perhaps 10 feet, either up or down, per minute.

"Second, to drive direct onto a line shaft by coupling the motor onto the line shaft by a friction clutch, or, if driven by a belt, to a good friction pulley.

"Third, to drive different parts of each paper machine by separate motors; for instance, pumps, such as suction, water or stuff pumps, should be operated by one motor, so that the speed of this part of the machine could be varied to suit different conditions of paper we might be making and which we conceive would be of advantage."

The following are some tests which have been made within the last few weeks at the Cliff Paper Mill as data for this article:

TEST OF 500-VOLT MOTOR OPERATING 102-INCH PAPER MACHINE AT CLIFF PAPER MILL, NIAGARA FALLS, N. Y.

	Average.		Horse Power.	
	Volts	Amperes	Total	Increment.
Motor operating counter shafting	495	96	63.5	....
Adding, wire	500	104	69 7	6.2
Adding, first press	510	110	75 0	5.3
Adding, second press	500	126	85 0	10.
Adding, dryers	508	134	90 0	5.
Adding, calenders	505	136	92 0	2.
Adding, winders	505	140	95.0	3.
Machine running 336 feet per minute, 24x36—27, 480 sheets	508	180	121.0	26.

It is notable that even when "the cost of oil is not one-twentieth of what it was with steam engines," still 63.5 horse-power is lost in shafting before the machine is reached, and 95 horse-power is required to drive the machine empty—all this is a constant loss required to utilize 26 horse-power for making paper; the efficiency is therefore 21½ per cent. It would be interesting to know what it was when the steam engines were in use.

In connection with these tests the following table, prepared by the engineer who made the tests, is of value:

APPROXIMATE POWER REQUIRED FOR DIFFERENT PIECES OF APPARATUS USED IN PAPER MILLS.

Water pump	10 to 20 H. P.
Beaters	30 to 40 H. P.
Saws and barkers	10 to 15 H. P.
Stuff pumps	5 to 10 H. P.
Elevators	3 to 10 H. P.
Cutters	5 to 10 H. P.
Exhaust fans	5 to 25 H. P.
Pulp grinders, 27-inch stone	250 to 350 H. P.

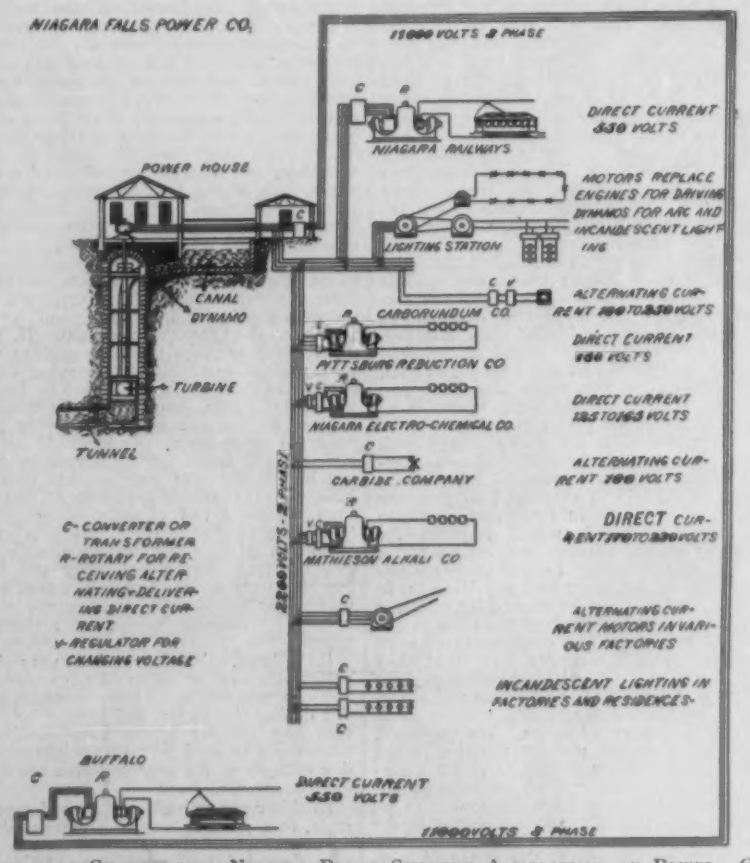


Diagram of Circuits from Niagara Plant, Showing Applications of Power. Over 1,800 H. P. in Induction Motors at Buffalo Have Been Installed Since Diagram Was Prepared.

ELECTRIC POWER FOR PAPER MAKING.

Transmission—Ordinarily the mill must go to the water power; by electrical transmission the power can be brought to the mill. The mill may be located conveniently as regards site of buildings, receipt of raw material, shipment of product, accessibility for workmen or other local or economical conditions. Electric transmission enables separate water powers to be concentrated at one point.

Distribution—The arrangement of main lines of shafting and belts is not the fundamental element in the plan and general design of a mill where electric motors are employed. Considerations of convenience, cheapness and economy may now receive prime consideration in laying out buildings and placing machinery in a new mill. Electric wires, as conductors of power, are in pleasing contrast to shafting, belts or steam pipes, as they are small, motionless, easily supported; they require no attention other than to secure mechanical protection, do not wear out, leak or get out of line; they may be run overhead, underground, around corners; they are simple, efficient and cheap. Furthermore, different parts of a mill become independent and there is a general flexibility in its operation. There is no dead load of shafting, taking its unknown quota of power for good, bad and indifferent bearings, independent of whether one machine or fifty are being driven.

Electrical transmission and distribution make possible new methods, which often may be found to effect the economies which a growing competition requires.

The electrical distribution of power can be secured either when power is transmitted from a distance, or when it is furnished by engines located in the mill—as has been demonstrated in many factories and mills in other industries. The advantages of the distribution of power by motors are unquestioned; the only real question is relative cost.

The Castner processes, as exemplified in the works of the Mathieson Alkali Company at Niagara Falls, being electrolytic, add another application of interest and usefulness to which the electric current might be put by the paper producer.

The raw material, common salt, chloride of sodium, dissolved in water, is fed into the cell built up of slate slabs, and the current entering at the carbon terminal, or anode, carries the metallic sodium with it to the mercury cathode, where it unites with the mercury, forming an amalgam. The chlorine, the other element of the salt, is liberated at the carbon terminal, where it is drawn off by means of an electrically driven exhauster. The cell is divided into three compartments, and is arranged to rock back and forth. The two outside compartments are alike, while the central compartment is somewhat different. Here the mercury and amalgam form the anode and an iron grid the cathode. Water is fed into this compartment, the current causing it to unite with the sodium of the amalgam, forming sodium hydrate or caustic soda. The hydrogen liberated passes off into the air.

We now have two useful products from the cell—chlorine gas and caustic soda. The caustic liquor is conveyed to huge kettles, where the water is driven off by heat, the finished caustic being a solid substance of almost snow whiteness. The chlorine gas is conveyed to lead chambers, the bottoms of which are covered with layers of slacked lime to the depth of about 4 inches. This lime being finely powdered acts as a sponge, absorbing the chlorine gas. The lime contains from 35 to 38 per cent. of chlorine.

In the electrical room of the Mathieson Alkali Company there are eleven rotaries of 170 horse-power for transforming alternating current from the Niagara generators into direct current at a voltage controlled by regulators in the form of hand operated dials, one for each machine.

OTHER USES OF ELECTRICITY.

The use of electricity for lighting, the convenience and safety of the incandescent lamp, and the cheapness of the arc light for general illumination, are too well known to require comment. Many mills have electric light. Electric light and power may be obtained from the same system.

Another use of electricity in connection with paper mills, suggested by one of your members, is for the transmission and sale of surplus water power to neighboring cities or towns.

Electricity cannot be applied indiscriminately to all purposes with beneficial results. Some time ago a gentleman wrote me regarding the heating of rolls in his paper mill by electricity. He said a 100 horse-power boiler did the work, but he would like to use electrical apparatus, as he had a water power which would give 100 or 200 horse-power. Now a "100 horse-power boiler" is one which will supply steam to an engine which will give 100 horse-power output; the actual energy which is in the steam and which is effective for heating is about 1,000 horse-power—a 1,000 horse-power electric plant would be required to replace a 100 horse-power boiler. The steam plant has an actual efficiency of about 10 per cent. for supplying mechanical power, or an apparent efficiency of about 1,000 per cent. when used for heating.

PAPER IN ELECTRICAL APPARATUS.

Paper is extensively used as an insulator. Almost without exception every dynamo, motor and transformer, many kinds of auxiliary electrical apparatus, and some cables, contain paper. It is used in the form of bond paper, rope paper, express paper, fuller board or press board and vulcanized fibre. Dry paper is a good insulator, and its flexibility and mechanical strength are superior to that of most insulating materials. It forms a good carrier for insulating materials such as gums, varnishes and paints. Its specific inductive capacity is low, adapting it for telephone cables.

ELECTRICITY AT NIAGARA.

Electrical progress of recent years is not so readily found by searching under the starthing electric headlines in the imaginative and sensational newspaper as in examining modern electrical machinery in the factory or in service. More intelligent design, both electrical and mechanical, better adaptation of each machine and each part to its specific work, improved materials and processes of manufacture, larger sizes and perfected details mark a substantial progress in engeering.

The largest exhibition of electrical operation is at Niagara. This installation presents engineering achievements of great magnitude, an electric system of great adaptability and flexibility, and an aggregation of new industries. The numerous applications of the power taken from the same generators are shown in the accompanying diagram. Since the diagram was prepared over 1,800 horse-power in induction motors has been installed in a number of grain elevators and other industries at Buffalo. The following paragraphs are taken from the paper with which the diagram was recently presented by the writer before the Engineers' Club of Philadelphia:

"The current from Niagara generators is supplying almost every kind of electrical industry. It is transformed into direct current at constant voltage and at variable voltage. It is transformed as alternating current to a low voltage, either constant or variable, and to a high voltage for transmission—from two phases to three phases. The current is used for developing mechanical power which replaces steam engines, does miscellaneous work and operates street railways. The current is used for lighting and for ordinary heating. In the new processes it is used for its electrolytic and heating effects. Heating is produced both by direct passage of the current through materials sometimes in liquid, sometimes in solid form, and by the electric arc.

"The important enterprises at Niagara are new. The processes are among those which electricity has so recently given to the arts. They are large consumers of power, and their commercial practicability depends upon its cheapness. In ordinary manufacturing industries the cost of power is a small percentage of the cost of material and labor, and the power is used only a small part of the day. In the industries at Niagara the cost of power is the vital element, and while on the one hand their continuous operation makes them ideal customers of a water power plant, on the other hand they are significant omens of the advance in industrial methods which is made possible by abundant and cheap power."

The Economical Use of Steam in the Manufacture of Paper.

BY CHARLES E. EMERY, PH. D.

A prominent feature of modern industrial progress consists in doing business on a large scale. It has been found possible to greatly increase the size and capacity of single mechanical units, and thereby increase the output and reduce relatively the operating expenses, so that the cost of production has been lowered, the public has obtained lower prices and responded with a larger demand, and, as a rule, the manufacturers' profits depend, much more than formerly, upon the volume of business than a large difference in the cost of production and the net selling price. At first our railway cars were modeled after road carriages, conveying comparatively small loads. The cars were gradually made larger, but the dead weight at first increased in fully as great a ratio, until for years our freight cars carried 20,000 to 22,000 pounds and weighed 18,000 to 20,000 pounds. Now cars are built to carry 40,000, and even 50,000 pounds, upon eight wheels, and the introduction of this principle in coal cars has made it possible to deliver coal at competing points at the rate of one-half a cent per ton per mile. Single blast furnaces, which years ago rarely had an output as high as 10 tons of iron per day, are now built to yield 100 to 120 tons per day. The increased capacity of the

railroads was due simply to doing business on a larger scale by the introduction of more power, larger vehicles, and a roadbed amply able to carry them. The increased production of the blast furnace was due to increased size, to the hot blast, and to an increase in the supply of air.

The same progress has been made in paper manufacture. Our first impression of a paper mill is a long, low building, situated on a comparatively small stream, provided with a single paper machine, or, at the most, two, operated at a slow speed, the dryers being heated by steam from a single boiler of small size, and the whole business conducted by the members of one family. There were larger plants on larger streams, but they were practically aggregations of smaller ones. Gradually the output of single machines has been enormously increased both by increase in size and in speed, the latter having been made possible principally by greater facilities for drying the paper, the increase in the number of dryers being the most evident change, like the increased number of blowing engines in connection with the modern blast furnaces. Mechanical details have also been perfected, so that instead of a speed of 100 to 150 feet per minute it is now found possible to operate at the rate of 500 feet per minute on some classes of work, and obtain an output under favorable circumstances as high as 30 tons per day from a single machine.

The increased output has required a great increase in the steam plant of paper mills, and naturally manufacturers are continually inquiring whether economies cannot be secured in this branch of the business. It may be assumed generally, with perhaps special exceptions, that the incidental uses of steam, such as that required for bleaching, heating the buildings, etc., are independent of steam for power purposes, of small importance in comparison with the quantity of steam required for heating the dryers. It is assumed also that in general water power is available for all preliminary operations, particularly for operating the beating engines, but that it is desirable to operate the paper machine with steam power, which is steadier, while readily permitting desired changes of speed. As it is possible to operate an engine of sufficient power to drive the machine with steam used afterward to dry the paper, the cost of steam power is substantially proportioned to the quantity of steam required for the dryers, plus 10 to 15 per cent. chargeable to the engines, plus that used for incidental purposes about the mill for bleaching, heating, etc. If, in any case, a steam plant is required to assist the water power, it should be considered independently, though the first cost may be considerably reduced by constructing a single boiler plant and massing the engines at one location.

The speaker is informed that as the paper passes to the dryers it contains about 28 per cent. of solid matter and 72 per cent. of water, and that about 5 per cent. to 9 per cent. of water can be left in the paper after it is apparently dry, as it would absorb that amount from the atmosphere were it made absolutely dry. The latter percentage applies to the solid matter in the paper and is therefore only about (7 per cent. of 28 per cent.)=2 per cent. of the weight of the original wet fragile web which is conducted to the dryers. It follows, then, that 28 per cent. + 2 per cent. = 30 per cent. of the original weight remains in the finished paper and 72 per cent. —2 per cent. = 70 per cent. is in the form of water which must be evaporated. There must, therefore, on this basis, be 70÷30=2 1-3 pounds of water evaporated for each pound of paper produced. The evaporation takes place into the atmosphere and each pound of water evaporated at 212° carries off 212.9 thermal units of sensible heat above the zero Fahrenheit, and 965.7 thermal units in the form of latent heat, so that the total heat above zero carried off is 1,178.6 thermal units per pound of water evaporated. The water of condensation in the dryers should be collected and returned to the boiler at the temperature due to the pressure. For a pressure of 5 pounds above the atmosphere the temperature would be 227.1°. Allowing 2° for loss in transmission the feed water at a temperature of 225.1° would return to the boiler 226.1 thermal units above zero, so that the heat taken from the boiler per pound of water evaporated would be 1,178.6—226.1=952.5 thermal units, or for each pound of paper produced two and one-third times as much = 2,222.5 thermal units.

The absolute calorific value of the best bituminous and semi-bituminous coal is about 15,500 thermal units per pound of dry coal, containing a small percentage of ash. The calorific value of the better kinds of fairly clean commercial anthracite and bituminous coals varies from 13,000 to 14,000 thermal units per pound, or, say, 13,500 thermal units on the average. The calorific value of pea and buckwheat coals varies between 11,000 to 12,000 thermal units per pound, say 11,500 thermal units per pound on the average. The differences in calorific value of different coals are very great, and the proportion of the same that can be utilized in the boiler varies still more. Some of the bituminous coals contain so much volatile matter that the efficiency, or the proportion of the theoretical thermal value which can be utilized in practice, is less than that for coals not so highly bituminous. With grades of coal mentioned as having the highest calorific value, evaporations have been obtained as high as 10 and, in some cases, 11 pounds of water per pound of coal, corresponding to 73 to 75 per cent. efficiency for varying calorific values in the different cases. These results, however, have been obtained under experimental conditions and generally from boilers having very small, thin tubes not adapted for use in a paper mill. Economizers were also used in connection with these boilers. The best practical result which can be hoped for in average practice with commercial coal is about 9 pounds of water per pound of coal evaporated under actual conditions, and, with the cheaper grades of pea and buckwheat coal, only 7½ to 8 pounds evaporation will be obtained on the average. For mills situated near the coal regions, where the cost of transportation is low, the small coal can be employed to advantage, but when the coal is transported a long distance the transportation cost per ton of small coal is as great as that for the larger sizes, and the latter will generally be more economical at a higher price, though the question is one to be settled by the circumstances of each particular case. Assuming that the boiler plant is of a type above the average, that it is well managed, and that a good commercial coal is employed, we may, with hope of doing better under exceptional circumstances, assume an evaporation of 9 pounds of water at a pressure of 80 pounds from the feed water temperature of 225.1° above mentioned. Each pound of steam will then have derived from the fuel 989.8 thermal units, and for each pound of coal there will be utilized nine times this, or 8,908.2 thermal units, corresponding to 66 per cent. efficiency for an average calorific value of 13,500 thermal units, which shows room for improvement, but is difficult to obtain under the conditions of regular working. As we have already found that 2,222.5 thermal units will be required per pound of paper, on the basis previously assumed there will be 8,908.2÷2,222.5=4.008 pounds of paper dried per pound of coal, or, in round numbers, the drying of each pound of paper would require one-quarter pound of coal if the steam were taken direct from the boilers. Adding one-eighth or 12½ per cent., as explained hereafter, for the reason that the calorific value of the steam will be reduced by utilizing the extra pressure to operate the machine through a steam engine, and again 10 per cent. for incidental uses of steam and transmission losses, the coal consumption should not exceed 0.3094, say five-sixteenths pound for each pound of paper manufactured. If we allow that some exhaust steam from the engine will be wasted at times, there should be at least three pounds of paper manufactured per pound of coal.

The general interest in the subject of reducing the amounts paid for drying the paper has raised questions whether or not the cost could be reduced by introducing direct heat in the dryers from incandescent fuel or gas, or if the heat could be transferred more economically from the fuel to the drying cylinders by any other medium than steam. The speaker thinks not. To be sure all the heat in the fuel is not imparted to the water in the boiler, but the losses are no greater and probably less than would be incident to any other form of furnace. It is evidently impracticable to build a fire in or under a drying cylinder. The difficulties in conveying away the products of combustion and in arranging the complicated flues required to reduce the temperature of the gases and impart the heat to the paper, so as to prevent a large escape of heat to the chimney, are insuperable.

As to other mediums of conveying the heat from the furnace to the dryers, hot water would be available and would be equally efficient with steam if properly carried out. Complicated passages within the dryers would be necessary if the cylinders were not entirely filled with water and in any case the weight would be very greatly increased, causing increased friction and, in case of accident, increased danger to life, as the storage capacity for heat in a mass of water is enormous. A man may safely pass his hand through a jet of issuing steam when he would be scalded instantly by a few drops of boiling water. Hot water is employed in greenhouses, and some of the better class of dwellings for heating purposes, simply because the large mass of water in the pipes prevents sudden changes of temperature, and, moreover, the heating can be done at a temperature less than that due to atmospheric pressure, so that a little heat can be obtained regularly in mild weather. None of these advantages apply in heating the dryers and in any event there would be nothing saved by the use of hot water, so we need not further consider this branch of the subject. The same objections that apply to hot water would apply to any other fluid. There only remains some indirect means of heating. For instance, gas could first be manufactured from the coal and then burned within the dryers, but, independent of economical reasons, one can see that great care would be required if the machine were stopped to prevent one part of the dryer becoming hotter than another. Moreover, constant care would be required to keep the quantity of gas burning in each proportioned to the work done therein, whereas with steam the temperature is as steady as the steam pressure and no part of the dryer would be unequally heated with proper drainage. Independent of these considerations the application of heat is indirect. Coal is first employed to generate gas, which is a wasteful operation, and then gas is to be burned, which requires for economy special burners with openings for the gas and openings for air properly adjusted one to the other and provision made so that heat will not be wasted by currents of air through the openings required to adjust the burners. The originators of such a scheme would certainly wish that they had some method of transmitting heat which would need little attention and maintain a constant temperature, exactly as is secured by the use of steam. We conclude, therefore, that the present practice is the best; that for every pound of paper a certain weight of water must be evaporated; that the fuel required for the same can be burned economically under a steam boiler and the steam transmitted with minor losses to do the work, the water of condensation being returned to maintain the supply of feed water. If our assumption to the proportional weight of water in the paper as it approaches the heaters be correct, there is no way to avoid burning at least one-quarter pound of coal per pound of finished paper for the simple purpose of drying such paper. The other allowances stated are subject to correction, according to the actual conditions at particular locations.

As a matter of interest, it may be stated that under peculiar conditions an evaporation of 20 pounds or more of water per pound of coal is possible instead of 8, 9, or say at most 10 pounds, which we have considered practicable in a paper mill. This high result is, however, only obtained by multiple evaporation, or an evaporation in series, in which there is first an ordinary steam boiler provided with a furnace in which fuel is burned in the usual way and with usual economy. In this boiler steam is generated at a high pressure and conducted to a second boiler in the form of a tubular heater in which the steam boils water and generates steam of a little lower pressure. This steam is employed to generate steam at a still lower pressure in a third boiler, the steam from the third generates steam in a fourth, and so on till the pressure is reduced nearly to that of the atmosphere. The water condensed in the first of the steam heated boilers is returned to the fuel heated boiler and does not affect the result. In all of the remaining steam heated boilers the steam delivered from either one is condensed in heating the next and the water of condensation withdrawn as distilled water, so that the aggregate evaporation may be as high as stated. Evidently this plan is not applicable to drying paper, because that must be dried under atmospheric pressure and, as the steam and vapor pass away, the heat is not recoverable. Possibly some metallurgical operation requiring the use of a large quantity of steam without pressure may some day come to light which will make the escaping steam a valuable by-product and thus indirectly reduce the cost of drying paper, but no such means are known to the speaker at the present time.

We call attention, however, to the fact that if in the manufacture of fine paper it is required to purify the water supply and the impurities are of a character that they cannot be removed by mechanical filtration after precipitation by chemicals, it is possible to use the steam finally supplied for the dryers, first at a high pressure to evaporate water in a steam heated boiler, perhaps repeating the operation, and finally to use the resulting steam to heat the dryers as at present when the water of condensation in the steam heated boilers could be used for the special purposes referred to. This possibility is mentioned more to interest the auditors and show the resources of various branches of engineering than to furnish the solution of any problem now confronting us.

It is, however, both practicable and economical to use the steam from the boiler, first for power and afterward for drying the paper and other heating purposes. This system is common in paper manufacture, but I find that some persons still doubt its economy.

In the operation of a steam engine the steam actually condensed for the work done is less than 3 pounds per horse-power per hour, and as in non-conducting engines 30 to 40 pounds of steam are required to practically produce a horse-power for one hour, it follows that not more than one-tenth of the heat will be abstracted in using the steam first for developing power, and that nine-tenths of the heat will be available for heating purposes and is as valuable, therefore, as if taken directly from a boiler at the same pressure. It has become quite common in cotton mills to use exhaust steam in the preliminary operations of dyeing and in manufactories of all kinds to use such steam for heating purposes during the winter. For engines where the whole exhaust is utilized for heating purposes it has become customary in some mills to charge 85 per cent. of the cost to heating and 15 per cent. to power. In our previous analysis of costs we have considered that 12½ per cent. is sufficient to charge to power, and this will still leave a fair margin for losses in transmission. Compound condensing engines, however, can be employed to furnish the power to drive the machine, for in round numbers one-half the cost of the steam used on the exhaust system for both power and heating purposes, but in water power mills where steam power is employed only to run the machine it would be necessary also to use live steam for the dryers. In such case the relative costs would be as follows: For exhaust heating, seven-eighths for heating and one-eighth for power, a total of 114.3 per cent. of the heating cost, whereas with live steam the heating would cost 100 per cent. and the power 50 per cent., so the saving due to exhaust heating compared with the use of the most economical engines to drive the machine with direct heating would be 100 (150—114.3)÷150=23.8 per cent. If, however, ordinary high pressure engines were used with direct heating the saving due to the use of exhaust steam would be fully 50 per cent. Again, however, if the whole or a large part of the whole mill were to be operated by steam power it would be possible to take steam for the drying cylinders out of the receiver between the two cylinders of a compound engine at less cost than to use a full exhaust system. This "bleeding of the receiver," as it is called, would in general not be practicable with a compound engine operating the paper machine only, as all the steam would be required for the dryers, making the engine practically non-condensing, as already assumed.

It follows, therefore, that very large economies can be obtained both theoretically and practically by using exhaust steam for drying the paper, and it may be added that any failures which have resulted in attempting to utilize this principle must be due entirely to the way in which the details have been carried out.

In this connection it will be of interest to state, in a general way, the means adopted to secure economy of steam in the large oil refinery of the Tide Water Oil Company at Bayonne, N. J., involving among other things the utilization of exhaust steam on an enormous scale. Though the business differs from paper making, very many of the questions involved are applicable in the operation of any steam plant. The present works represent the consolidation of several independent plants and occupy about half a square mile of territory. About 5,500 horse-power of boilers were originally installed in four boiler houses erected in different parts of the grounds and the consumption of coal for steam purposes was about 64,000 tons per year, independent of a very large quantity consumed directly under oil stills. The steam was used to operate engines in the paraffine and other departments, in the barrel, can, box and other factories; to operate a large number of steam pumps used to transfer the oil and finished products to different parts of the yards and to the docks for shipment; to press out the paraffine or wax in the heavier oils; to operate hydraulic presses for higher pressures, and to pump water in large quantities for cooling purposes, ammonia for refrigeration, etc. Steam was also supplied to several small plants for electric lighting. A very large part of the steam supply, however, was required for various heating operations connected with oil refining. The several superintendents and engineers were educated men of the highest order, and had been investigating the possible saving of steam by various methods. A copy of a paper by the speaker, showing the enormous consumption of steam in ordinary steam pumps, had been studied, and it had been considered desirable to replace many of such pumps with power pumps. Exhaust heating had been used somewhat, particularly for maintaining the temperature of the tanks in winter, and its more extended use had been discussed. The steam pumps of various sizes were scattered in all parts of the large area, some in buildings, others exposed in the air, and the length of steam pipes required to reach all the outlying points where power and heating were requiring was very great and caused a large condensation of steam. A prominent electric company had submitted a proposition to substitute electric motors to supply power at the different locations, and electrically operated pumps in place of the steam pumps. It was proposed to mass the high pressure boilers at one part of the yard in connection with engines of high economy, operating large dynamos to supply the electrical energy, the other boilers to be used to furnish steam for heating purposes. No agreement could be reached between the various engineers and directors of the company, and the speaker was called in consultation. It was found that a very large proportion of the steam was used for heating purposes and the large electric plant was not approved. A smaller electric transmission was recommended to reach various outlying points where steam had to be transmitted a long distance at a very great expense in condensation, independent of the power developed, since it was necessary in winter and desirable in summer to keep the pipes warm all the time, although the power was at many of the points only used occasionally. An extension of the exhaust system was recommended even if it became necessary to increase the back pressure, and it was urged that exhaust steam be used for all heating purposes, instead of live steam. As it appeared probable that more exhaust steam would be available than could be employed for heating purposes, it was recommended that special plants, with power pumps and economical engines, be erected at various parts of the grounds and particularly in the paraffine department. Without going into full details it is sufficient to say that the recommendations were adopted, and carried out efficiently under the directions of the superintendents of the company, and resulted in a saving of fully one-half the coal required for steam purposes, or 32,000 tons per year. One boiler house was entirely shut down, another partially so, and considerable saving in labor effected, so that the saving for the first year was upward of $50,000, after deducting the cost of making the changes. The greater portion of this saving was undoubtedly due to the use of exhaust steam, but the cutting off of small steam pipes running to the docks and obscure corners, and the use of an electric plant to supply power in these localities, had its influence on the comparatively small portion of the power operated in this way. A single three-phase dynamo erected alongside a large economical compound pumping engine, and requiring no additional cost for labor, furnished electric current for both power and lighting, and the three small lighting plants were dispensed with. The interest evinced by the large staff of intelligent engineers and superintendents, and their careful attention to the subject, moreover, secured, in consultation with the speaker, economies in arrangement of piping, in protection from radiation, and in the management of fuel, which had also an influence on the result. Before the changes the grounds were overhung by clouds of escaping steam. Now hardly any is visible. In comparison it seems like Sunday, or as if the work was stopped, whereas actually the output is fully as great as before. In so large an establishment there were very many details touched upon of great interest which it will be impossible here to recount, though it may be desirable to refer to some of the same in connection with further remarks it is proposed to make with special reference to the economical use of steam in the manufacture of paper.

The quantity of steam used in a modern paper mill is so large that great care should be taken in designing all the details of the steam plant. The principles to be employed are exactly the same as in designing the steam plant for a large electric lighting or power station, or for any large manufactory. First, in order to save labor and secure efficiency, it is desirable that the boilers be massed together, and the engines also, so far as practicable. With comparatively small plants, the boiler room can be arranged at right angles to the engine room, so that the engineer on duty with the engine can through glass doors have a supervision of the fire room and secure the efficiency due to having all the work done under the control of one head. For larger plants the boilers are generally arranged in a separate building parallel with the engine room, in which case additional supervision is essential.

Every new steam plant should be carefully laid out and studied before construction; the boilers, engines, coal bins, and all details being arranged to secure the most economical results with the least labor.

The coal supply for a large mill should be secured during mild weather, when transportation rates are lowest and provisions made for storage on the premises. It always pays to house the coal, except where its cost is nominal. Bituminous coals and the softer anthracite coals lose a considerable proportion of their calorific value by exposure to the weather, and there is a decided loss with any kind of coal if it is necessary to mine it out of the pile in the winter, and bring with it a certain quantity of snow and ice, which, melting in the fire room, makes the coal wet, and the moisture must be evaporated uselessly in the furnace at the same cost as if an equal weight of water were evaporated in the boiler. There are exceptions to the rule about housing the coal. The Tide Water Oil Company uses a very small size of buckwheat anthracite, purchased in enormous quantities very cheaply in the summer, and stored in one immense pile which maintains its temperature internally so well that the coal can be taken out by cars under a crust in winter, and they have not found it necessary to house it. This plan is not recommended where a different one can be employed. Of course, provision should be made to deliver the coal direct from the cars to the interior of a storage building, and to reduce the cost of handling the coal should be taken from the storage to the fire room as required upon cars or by the use of modern conveyors which may also remove the ashes.

The type of boiler selected must be adapted to the quality of water which can be supplied to it. The ordinary horizontal tubular boilers are very efficient if properly designed, set and operated. Vertical boilers with small tubes frequently give higher evaporations, particularly with economizers placed above them, but the economy of horizontal tubular boilers can also be increased materially by the use of small, long tubes if carefully managed. Both the vertical and horizontal tubular boilers of the shell type are necessarily in comparatively small units, and with small tubes are not adapted for the use of dirty water. This difficulty is not as important where the greater part of the steam is used for heating purposes, and the water of condensation returned to the boiler.

There is some danger in connection with all cylindrical boilers of ordinary type, and an explosion becomes very serious in the midst of the other boilers of a large plant. This and other considerations have caused the introduction of a very large number of sectional boilers for all kinds of industrial work; in fact this type of boiler is in use in most of the large steam plants. Some of these boilers can be forced to double their rated capacity in case of emergency, and at the same time give ordinarily as high an evaporation as the average run of boilers of ordinary types. Moreover, as a general rule the repairs upon the better forms of sectional boiler are very much less than for ordinary boilers. Sectional boilers are, moreover, made in larger units, generate steam freely and rarely fail to give satisfaction.

The first station of the New York Steam Company was designed by the speaker to contain sixty-four sectional boilers of 250 horse-power each, a total of 16,000 horse-power. The boilers were arranged in four tiers with sixteen on each floor, facing a central fire room, there being a rectangular chimney in the centre of each row. In this way this immense power was massed on three city lots, each 25 feet in width, and about 125 feet in depth. The coal storage was above the boilers, the coal conducted to the boiler fronts by chutes on alternate columns, and the ashes conducted away to the cellar by chutes in front of the intermediate columns. The power not being at once demanded, only three stories of boilers and one for coal storage were originally constructed, and as the boilers operated most economically at 20 per cent. above rating, it has only been found necessary to put in a few additional boilers to obtain the 16,000 horse-power in winter originally desired.

On account of the high price of dock property in New York, the coal had to be brought to the building in carts. It was dumped into cars which were backed through the cellar under the front area of the rear building, and such cars were run to an elevator in the boiler house and lifted to the top, where they were run out over the coal storage and the coal dumped. Similar cars in the cellar received the ashes and were run on the elevator, carried to the top of the rear building, and delivered the ashes through a chute to a cart backed into a niche in that building. This is still the largest boiler plant in the world. To be sure, the large steamers of the Lucania class contain over 30,000 horse-power, but this is on a compound engine basis of 15 pounds per horse-power per hour, whereas the boilers of the Steam Company are rated on a 30-pound basis and run regularly at 20 per cent. above capacity. The multiple story plan has been followed in constructing some large electric stations in several cities, but it will not be necessary in ordinary steam plants. The speaker has not yet found any of the recently constructed large stations which operate with more economy than that of the Steam Company. As the coal flowed to and the ashes ran away from the firemen there was no difficulty in operating 600 horse-power of boilers (1,200 horse-power on a compound engine rating), with one man, and though the modern coal conveyors have undoubted advantages compared with the system adopted in the Steam Company's plant, the work was on such an enormous scale there that no saving is known to have been made in operation.

Automatic stokers of various kinds have been applied for a number of years. The capacity obtained per man with those of the original type proved inferior to that obtained by the Steam Company's system, so the speaker has not been impressed with the value of such devices. He is now assured, however, that they are perfected to such an extent in connection with modern means of hoisting the coal and removing the ashes that very little labor is required. A careful investigation of the more modern of these plants would be necessary to ascertain if such is the fact. There is, however, a better chance for economy in this direction in a paper mill, where the demands for steam are nearly uniform, than in an electric light station, where the demands are so extremely variable throughout the day, and a load liable to be brought on suddenly in case of a storm.

In order to secure maximum economy it is desirable that economizers be used in connection with all types of boilers. The-

oretically the economy in well designed boilers depends upon the area of the heating surfaces, but not in direct proportion. With a coal consumption of 15 pounds per square foot of grate, careful experiments showed that 4.68 pounds of water were evaporated from and at 212° per pound of coal, with the heating surface only three times the grate area, or about the same as is exposed in the furnace of a marine boiler. With heating surface six times the grate 2.6 pounds additional were evaporated, or 7.28 pounds in all, and the results due to increased surface were as shown in the following table:

Heating Surface to Grate.	Evaporation from and at 212°.	
	Addition by Increased Surface. Pounds	Total. Pounds.
3	4.68	4.68
6	2.60	7.28
9	1.54	8.79
12	.97	9.76
15	.63	10.39
18	.51	10.90
21	.40	11.30
24	.31	11.61
27	.24	11.85
30	.18	12.03

In regular practice the evaporations are ordinarily only about eight-tenths of those given above. Evidently the surface would need to be very greatly increased to obtain any material increase of evaporation. It is not ordinarily customary to construct a boiler with more than 25 to 30 square feet of heating surface per square foot of grate, or, what is more important, to operate a boiler so that more than 0.5 to 0.6 pound of coal is burned per square foot of heating surface. The additional surface necessary to reduce the rate of combustion per square foot of heating surface is usually erected as a separate structure called an economizer. Its office is that of a feed water heater, and as the temperature of the feed water is lower than that of the water in the boiler, the surface is more efficient than boiler surface. Frequently economizers bring the temperature of the products of combustion so low that the moisture in the escaping products of combustion is condensed and causes corrosion of the tubes. It is desirable, therefore, to make them of cast iron, which corrodes less easily. The automatic system of continuous cleaning is also desirable. At the Tide Water Oil Company one of the superintendents set up a number of old horizontal tubular boilers to form an economizer, and while the speaker expressed a fear that the tubes would soon become corroded and require renewal, such has not been the case at the latest advices, for the reason that the boilers are used continuously day and night, and as this is the condition in a paper mill it appears that a somewhat cheaper construction of economizers may be adopted when all the conditions are studied.

Great care should be taken in connecting the several boilers so that the current of steam from one will not retard the flow from others. Care should also be taken to avoid pockets in which water of condensation may lodge when boilers are shut down, and cause danger from water rams when steam is turned on.

Everything about the steam machinery of a paper mill should be of a reliable character, without great complication, as many intricate details would be liable to derangement, and cause a stoppage of the plant much more damaging than minor savings in fuel for a considerable period. The engine driving the machine should particularly be of comparatively simple type, with all parts readily accessible, and with details that can be readily replaced. It is a question whether in some important mills it would not be better to duplicate the engine and driving attachments.

The keynote of saving by the use of exhaust steam is never to allow any steam to escape. Therefore care should be exercised in selecting an engine of the proper size. It should furnish the power to operate the paper machine with a reasonable degree of expansion, and without delivering more exhaust steam than is required for the dryers and other regular heating purposes. The pressure to be employed should be well considered in relation to the power required for the machine. The higher the steam pressure the more economical the engine, but the greater the losses by condensation in the various connecting pipes. The pressure must be sufficient so that all the power required will be obtained from steam used afterward for heating purposes, when, if there be deficiency of exhaust steam, the low pressure supply may be augmented with live steam direct from the boilers, and in certain cases from boilers operated at a lower pressure, and there will be no material loss, as the whole quantity of steam will be used for heating purposes and the power be obtained for a nominal cost, as it only requires about one-eighth of the heating power of the steam which passes through the engine, as previously explained.

The water of condensation from the dryers should be returned to the boilers at as nearly the full pressure supplied thereto as possible, so as to keep up the temperature of the feed water. Each 10° increased temperature of feed water corresponds to a saving of 1 per cent. of the fuel. Hot water can be pumped successfully if it be kept under pressure. It may be necessary to lower the pumps, so that there will be a slight head upon them, but this can be generally accomplished without difficulty.

Steam pumps exhausting continuously into the atmosphere should not be tolerated for any purposes. If used at all they should exhaust into the low pressure pipe leading to the dryers. So much steam is required to operate such pumps that it will be very easy to obtain more exhaust steam than is required for heating purposes and its escape will, as stated, cause a direct loss. It is therefore better generally to depend upon power pumps operated at will either by the steam engine or by water power, though it is well to have steam pumps in reserve as auxiliary feeders and for fire purposes.

The speaker is informed that in some locations difficulty has been experienced in properly draining the drying cylinders. The water of condensation necessarily tends to collect at the bottom of each cylinder and continuously flows back toward it as the cylinder revolves. Such water needs to be lifted to or above the height of the trunnion before it will flow out. The simplest method of drainage is with a stationary siphon. One branch is extended to the bottom of the cylinder; the other should be carried down outside to a lower depth and connected through a hot water return system with a closed hot well from which the water is to be withdrawn by the pumps. Unless the steam supply pipes are very large the difference of condensation in different dryers will produce a slight difference of pressure in the same, so that the siphons from some of the dryers will act while those from the others will not, at least until quite an accumulation of water takes place. A great part of the difficulty may be obviated by setting a separate trap for each dryer. The so-called steam traps which operate by difference in temperature instead of the weight of the water are not steam traps at all. They are really heat traps; that is, they hold back the heat and operate as soon as the water reaching the trap cools. Some of these which will operate with a very slight change of temperature may answer as steam traps so far as drainage is concerned, but it is not desirable that the water should be allowed to cool. The correct form of steam trap is one in which the valve is opened by the weight of the water as soon as sufficient water accumulates to fill the bucket or lift the float operating the valve. Many of these devices have been so cheapened as to be at times worthless. Even with a separate trap for each dryer the traps will stop working if there be any air in the system, unless there be a pass-by opened all the time slightly so as to keep a current of air, steam or water moving through the siphon. A pass-by, however, can easily cause a very considerable loss of steam. The rule should be made never to permit the outlet of one to be concealed, for if it be and the pass-by be left open by misjudgment or carelessness steam may escape continuously and, if it goes to the atmosphere, it will be entirely lost, and if to the hot well may interfere with the action of the pumps. Pass-bys should be very small and open into the room. Then, as soon as the air is blown out in starting steam will follow and it will be necessary to shut them.

For these various reasons it is recommended that the siphon system be not adopted when it can be avoided. The well-known scoop method is much preferable, as the water in flowing around as the cylinder revolves will enter each scoop as it passes, be lifted above the center and run out of the trunnions to the return pipes. Exterior siphons may be used on the connections to allow for slight differences of pressure, as is common in connecting the risers of steam heating apparatus.

It is surprising how large a quantity of steam at high pressure can pass through a small fissure opening into the atmosphere. Frequently minor leaks are neglected, whereas if there be any considerable number of them they will increase to a perceptible degree the cost of the steam power. It is essential, therefore, that repairs be carefully looked after, and that no steam leaks be permitted. The pipe coverings, moreover, should be kept in good order so as to avoid direct waste of heat by radiation.

We may be expected to say a word in relation to that great auxiliary of steam and water power, viz., electricity. It is easy to be too sanguine on the subject. This unseen force can do so many things in such an excellent manner that those who have not had extensive experience with it imagine at times that it is a cure-all for difficulties and the acme of modern progress. Let us impress upon you that for all ordinary purposes electricity is a luxury. Still we Americans like luxuries and can afford them. No gentleman who has made a fortune would consider his house perfect without electric lights; modern office buildings cannot omit them, and in some branches of manufacture electric lights are so much superior to any other method of lighting that questions of relative cost are of no importance in comparison with superior results. Moreover, ample water power may be available so that the cost will be greatly reduced. If, however, it be decided to put an electric plant in a paper mill, never buy the cheapest. The danger from fire due to improper work cannot be neglected. In every manufactory, and particularly in the moist places about paper mills, the wires should be erected only in iron or steel pipes with tight joints, and everything else should be made to correspond.

Local electric transmission has its advantages where the points at which power is to be delivered are widely separated, and it is practicable by means of high tension electric currents to transmit power, for instance, from a waterfall for long distances, utilizing at the end of the line generally more than one-half the theoretical power of the water. Where water power is cheap and abundant this is desirable, as the annual cost will only be the interest on the installation added to the cost of maintenance. Under other conditions hold fast to what you already know to be good.

The speaker has at some length gone over: first, the general principles which have an important bearing on the uses of steam in the manufacture of paper, together with illustrations calculated to excite interest in the general subject. He has then endeavored briefly to point out the care necessary in relation to certain details of operation. He would in conclusion plagiarize a well-known sentence to the effect that "eternal vigilance is the price of"—economy. In the operation of any steam plant the regular routine duties of the engineer are sufficient to keep him occupied and it is with the greatest difficulty that he is prevented from falling into a sort of routine in regard to matters which must be attended to to keep the mill in operation, so that he does not worry in relation to features which seem to be going well and therefore do not threaten a stoppage. In a large steam plant it pays to have some one to look after details who has no routine duty, but who is on duty all the time and is of a sufficiently nervous disposition to drop in and look after matters at unexpected moments. In our previous remarks, which we have endeavored to clothe in very simple language, there will be found references to a number of details which need not so much frequent attention as repeated oversight, no matter how well everything appears to be working. The economies may not be large in individual instances and yet be of great importance in the aggregate.

We may assume that any engineer with proper self-respect and not tied down too much to routine from lack of reasonable assistance will have a pride in seeing that his machinery is kept clean, that it operates noiselessly, that leakages are stopped, and in a word that everything is kept in apparent good order. He will also satisfy himself during the hours of stoppage that pistons and valves are tight and that the boilers are kept free from scale and the soot and ashes cleaned from the tubes of the boilers and economizers. All these things are of great importance; most of them are matters of observation by the proprietors and fix the character of the engineer, but there is one point which we have left to the last because it is the most important. It is to carefully look after the firing. Here the great waste in a steam plant occurs continuously. A corps of young engineers from the technical schools can come to almost any plant, post men here and there to take observations, and without the slightest interference with any of the practical details of operation report results which the proprietors by careful comparison will find, nine times out of ten, show a consumption of coal per pound of product, 15 per cent. to 25 per cent. less, during the time the experiments were in progress, than the average shown by the books for a long period of regular operation. This will occur when no part of the machinery has been changed, when the rate of production is the same as the average and the coal of like quality. The difference must then be chiefly in the way the firemen do their work. They know how to fire and will show their skill when there is a test in progress. If there were but a single boiler and it was somewhat difficult to maintain the steam pressure the fireman would have to show his skill continuously, but when there are a number of boilers and particularly when there are a number of firemen, for one excuse or another more boilers will be put on than are required for the work; the firemen will on opening the doors make the fires considerably heavier than necessary, thereby saving themselves the trouble of firing more frequently and with more care. Holes will burn in the fires of some boilers, allowing cold air to go through. Some of the firemen, and probably the best ones, will let their fires get into a condition of inactivity so that they will not require much coal, and the green firemen therefore will have to work harder to keep up the pressure. There are scores of details of this kind which there is no time to mention, but which any intelligent practical engineer already knows, or should know, and take steps to prevent.

We will only take up one more point. Frequently steam plants, not necessarily those of paper mills, have from long use become run down in some details, or they have been built up piecemeal, so that different parts designed for the same purpose do not operate co-ordinately. Pipes have been connected with a multitude of turns and fittings which ought to have been straight. A number of engines or a number of pumps are employed where one would be more economical. Boilers of different types are yoked together on the same stack with different percentages of heating surface in relation to the flue openings, so so that one set does not perform the work it should and another is overloaded. In such establishments the saying is well exemplified that "a fire would be a blessing," as it would then be necessary to reconstruct and it would possibly be done on a proper scale and in the proper way. Electric railway cars have their advantages, but it is not all due to electricity. In order to put in the new system the old tracks have had to be thrown to the winds and everything done in a better manner. It is our experience that in many manufactories a general change would be for the better, generally for the reason that work has been started on too small a basis and continued in what may be called an economical but in fact an illiberal spirit. In making improvements so much remains that is good that proprietors do not have the moral courage to build new from the foundations. It is, however, a fact that it is not always necessary. There is no infallible rule even in mechanics. People must get away from the humdrum of everyday life once in a while, see what others are doing, hear what others have to say, and then determine for themselves, as they would for another individual, what it is for their best interest to do, and to do it. Meetings of this character are in line with our suggestions, which we trust have proved of interest and may, when studied in detail, be considered of value. We thank you for your very kind attention.

Forestry and Wood Pulp Supplies.

BY PROF. B. E. FERNOW.

Gentlemen—When accepting the honorable invitation of your officers to address a group of business men at their annual meeting on the subject of forestry, I felt doubtful whether any good can come from such a general and theoretical consideration of the subject, such as alone can be given to it on such an occasion.

Is it likely that business men who have invested in their mills and plants, as the combined paper and pulp trade has to-day, probably over $200,000,000—and producing over 3,000,000 tons of material, worth over $100,000,000—is it likely that business men representing such interests need any advice of a general sort as to any portion of their business? Is it likely that they should have neglected proper consideration of the requirements of any phase of their business, at least as far as regards any general policy which they should pursue, in order to make the business profitable and the investment permanent and safe?

Yet the very invitation of your own officers for outsiders to discuss one phase of your business lends countenance to the supposition that there is felt to be a deficiency of consideration in regard to this one item at least, namely, the question of supplies of raw material, which, in my estimation, is the most important one in a manufacturing business that requires the outlay of considerable capital for plant and machinery.

As a business proposition, the discussion of forestry before you means largely a discussion of the future of wood supplies for the wood, pulp and paper trades, for forestry is nothing more or less than the rational use of forests, the art of managing and reproducing wood crops, the securing of future supplies.

Before entering upon this my main theme, you will, I hope, excuse a short digression, especially as the digression has a bearing upon the attitude which you may take to the main question.

The people of the United States, for perfectly intelligent reasons, are prone even in business enterprises to speculate rather than to employ their means in permanent investments. They will build mills, roads and other structures, and enter upon business with no expectation that their business and their structures need to last their lifetime; they are ready to abandon them when the basis for their speculation is gone, hoping that by that time the speculation will have netted not only a profit but also have reimbursed the outlay for mills and structures.

Thus a $50,000 saw mill will be established to cut out the available timber surrounding it within four, five or eight years, then to be abandoned: a mine will be equipped for operation, expensively, without any knowledge as to the likelihood that its stores will continue to yield for half a decade; and so on, the miller, the miner are ready to shift their base of operations at any time.

For such kind of business men it is useless to discuss the future, they have only an ephemeral existence in view. But gradually, as the pioneering days wear away, as the country fills up, as the rich resources have been exploited for their cream, and skim milk only is left, and as the bounty of virgin nature threatens to be used up within calculable time, the country must settle down to more conservative business; the need of considering the future forces itself upon the more thoughtful; mobility becomes less profitable, stability and permanency become a necessity, and continuity of the basis of its own existence must be taken into account in establishing or carrying on a business.

I take it that in an assemblage of men who have built costly mills, some of which have required an outlay of hundreds of thousands of dollars, there will be those who look upon their plants not as speculations, but permanent investments, who can therefore appreciate a conservative policy and who may be willing to look into the future, not only the immediate or the coming year, but the more distant in which, nevertheless, they themselves will still play a part.

And those who belong to the ephemeral sort may, after all, for a short half hour at least take an historic interest in the discussion of the future.

The wood pulp industry, as you are aware, is a development of recent times. Just a third of a century ago the first large pulp mill was established near Philadelphia, but the phenomenal growth of the industry began only within the last dozen years or so, during which the product has been doubled three times until now over one and a half million tons of pulp, two-thirds ground and one-third chemical pulp, is the annual output of the 1,200 mills, more or less, requiring not less than 2,000,000 cords of wood.

While the growth of the industry will perhaps not continue at the same rate as in the past, there seems no good reason why it should not extend further and continuously, for, in spite of the enormous increase in the use of wood pulp, there is as yet but one-third of our paper consumption supplied by this material. At any rate we may for some time to come consider the consumption of 2,000,000 cords of wood per year an exceedingly conservative figure upon which to base our considerations of the future supplies.

Where do these supplies come from? Although there are some broad leaf trees, or so called hardwoods, used for pulp, especially poplar, birch and maple, with little beech, basswood, gum and buckeye, the bulk of our wood pulp is made from coniferous wood, and especially from spruce, with pine, hemlock, cypress, fir and tamarack in smaller quantities. That is to say, the bulk of the pulp is made from that class of timber which is also most heavily drawn upon for lumber supplies in general; for of our enormous lumber consumption of nearly 40,000,000,000 feet B. M. at least two-thirds is coniferous material. Again six-sevenths of the pulp product comes from the Northern States and relies, therefore, on the coniferous soft woods—spruce, white pine and hemlock; furthermore, at present three-fourths of this product is from the Northeastern States—New England, New York and Pennsylvania.

Hence, for the present practical purposes, from the standpoint of the millowner, the supplies of this confined area would only need consideration. For it is unlikely that transportation of the bulkier raw material from any long distance to the mills will ever be practicable; the moving of the pulp mill to the bases of supplies would probably suggest itself more readily.

What are then the supplies of these soft wood conifers in the Northeastern States? In Senate Document No. 40 of the Fifty-fifth Congress I have attempted to arrive at some idea as to the condition of this resource on the basis of estimates from various sources.

In this connection, I will point out to you that it is a pitiable fact that we have as yet no reliable statistics of our forest resources, because no adequate provisions for obtaining them have ever been made. This lack is a testimony to our lack as a community of business sense, namely, that we do not know the status of the resource on which our most important productive industries—second only to agriculture—are based, industries in which over $1,000,000,000 of capital is involved, which employ over 1,000,000 workers, and whose product aggregates annually over $2,000,000,000 in final values.

With the knowledge in general that our forest resources are on the decline, would it not be wise economy to spend the two hundred or three hundred thousand dollars which it would take to ascertain precisely their condition, and thereby stimulate more careful use and recuperation? It would then be possible to speak with more assurance on the subject of the present inquiry.

Unquestionably an area of 40,000,000 acres, which is credited to the section under consideration as under forest cover, could, if properly managed, produce without difficulty and forever, annually, three or four times the amount now annually taken from it. But that only under proper management, which is at present lacking.

If there is a shortage in wheat crops or cotton crops two remedies suggest themselves at once: Economy in their use, which comes about naturally by the increase of price; an increase of the crop the next year to make up the deficiency. The governor, the regulator of supply and demand, works automatically, rapidly and instantly. The same remedies suggest themselves also for meeting a deficiency in wood crops, with the additional one of improvement in the machinery and processes of using the same. But there is one very essential difference in the two cases. The field crops mentioned are annual, the shortage needs to last only one season, is known readily and remedied readily.

Wood crops require many years to mature; the knowledge of even an approaching shortage is difficult to attain; the governor of all other trades which adjusts prices and thereby balances consumption and supplies on hand, works sluggishly in the case of wood crops, and only just before the danger point is fairly reached does it indicate overpressure.

Even now you are but little concerned, and the general public, which is finally the party more hurt by such loss or shortage of a valuable resource, sits in ignorance, awaiting its fate helplessly.

You know not and do not appreciate the situation, and probably believe me a croaker, knowing how thin my basis for conjecture, both as to present and future supplies, is. Yet I doubt whether any one of you knows the situation better or can bring proof that my conjectures are wrong. This only goes to show that our statistics of the wild growing wood crop are so deficient that they do not impart motion to the governor or balance wheel.

I suggest, therefore, that it is to your interest, as well as that of the public and its representative, the Government, to supply this defect in your machine: Secure sufficiently accurate knowledge of the condition of our varied timber resources and of their future promise. Such knowledge, I believe, will wake up our happy-go-lucky wood-working industries to a realization that their basis of supplies needs repair badly; that the glory of the times of bounty has passed, and we will for a time have to live on scant rations.

When once we know how far our virgin woods are depleted and how short the remnant, we may at least conclude that it will be wise not to squander the remainder uselessly. This will bring us to the next step, namely, to protect forest property against fire. The few feeble, half-hearted attempts at doing so in some of the States again exhibit our lack as a community of proper business sense and communal morality, for to protect life and property of its citizens is the first and primary function of communal life and government, and forest property has the same, nay greater, right to consideration in this respect, for it is property which cannot be restored except by many years of patient waiting. I would suggest that as a powerful association of men, most directly interested in this class of property, you insist upon efficient execution of this function in each State in which you are located.

Then, when the first essential for the conduct of any permanent and staple business, safety, has been secured and the influence of civilization extends into the wild woods, there we may apply the final remedy for our situation—forestry, the art of judicious management and reproduction of wood crops.

Just as the farmer sees to it that his field is fully stocked with useful plants, so the forester tries to have his land not only fully stocked, but fully stocked with the right kind of trees, useful and thrifty, keeping out or cutting out the weeds; for there are weeds as well among trees as among other vegetation. He harvests his crop when it is most useful, i. e., when it pays best considered from the standpoint of an investment, not a speculation; but at the same time, and here he differs from the mere logger, he secures a reproduction of the crop, for he proposes to stay in the business of growing wood crops, to hold on to his land as an investment.

This reproduction is by no means necessarily secured by planting, but it can be had merely by judicious cutting. The magnificent spruce forests of Germany which bear a burden of from 10,000 to 12,000 feet when 100 years old, of which 60,000 to 80,000 board feet is saw timber, with 250 to 350 trees to the acre, have mostly been secured not by the planting tool, but by natural reseeding under the guidance of nature by skillful foresters.

There is the greatest misconception in this country as to what is implied in this word "forestry," which twenty years ago was not even defined in our dictionaries. Even most of the enthusiastic friends who desire this art applied in the United States have had a curious notion of it.

Forestry is with regard to wood crops exactly what agriculture is to the production of food crops. At first the virgin soil responds without much trouble to the

scratching of its surface, but by and by the soil is worked out and it requires some knowledge to make it bear a crop again; the necessity of increased food supply and mismanaged soil capital creates the farmer; just so, when the virgin wood has been exploited, the necessity of increased wood supply creates the forester. Just as the farmer knows how to get from the soil a larger product and correspondingly larger money return for his labor, intelligence and knowledge, so the forester knows how to get—by entirely different means to be sure—a larger and better product and larger money return from his woodland.

Would you know how it pays to manage a wood crop instead of roughly exploiting it as you do? Take, as an example, the government forest administration of little Saxony, with a round 400,000 acres, mostly poor mountain land, and almost entirely spruce. There has just been published a most interesting record of the results of this administration during the last eighty years (1817-1895)—results of a systematic, rational management.

We will go back only forty years in order to make the comparison fairer, for industrial life, stimulated by railroad development, does not reach back much further. We find that while the net results of the administration during the decade 1854 to 1863 were only $925,000 annually in the average, or, with the then somewhat smaller acreage, over $2.50 per acre, in the decade 1884 to 1893 they were $1,900,000, more than double—or nearly a clear million dollars more—the net revenue being $4.50 per acre. Mind you, this is only revenue or interest taken while the property itself is not depreciated but improved, for we find at the same time that the growing stock of wood on the area had increased over 15 per cent. per acre, and the acreage in old material over sixty years had also increased 2 per cent.; several thousand acres of waste land had been planted, while also permanent roads and other improvements had been made and the property brought into better condition generally; so that figuring the revenue as representing only 3 per cent. on the investment, the value of the property had risen in those forty years from $30,000,000 to $63,000,000, or more than double. That is to say, the property has not only paid 3 per cent. annually in revenue, but added 2¼ per cent. annually to its value; and all this while the property is still in a period of improvement. Do you know of any large business in which all speculative values and contingencies are excluded that can do better?

Perhaps you are inclined to think that prices of wood may account for this great prosperity. To allow you to judge, I will state that forty years ago the price averaged 7¼ cents per cubic foot. This means wood cut to logs and billets ready at the roadsides for hauling, all over 3-inch diameter. At the end of the period it was 9 2-3 cents per cubic foot, i. e., an appreciation of 33 per cent. in forty years. This is difficult to translate into American measures, but it is certainly not very much higher than the cost for similarly situated areas in this country. How little, by the way, the price of wood has influenced the money results will appear from the statement that while the price for wood increased during the forty years by 33 per cent., the gross income from the property increased 234 per cent. and the net revenue over 80 per cent.

If we consider the results from the wood supply point of view, we get at an idea of what the forester still can do in securing a greater yield.

In 1854 there were on the area 860,000,000 cubic feet of stock, old and young wood, or 2,300 cubic feet per acre, which by 1894 had increased through conservative management to 1,100,000,000, or 2,675 cubic feet per acre. This is the wood capital accumulated, of which only the interest is used. Yet during that period there had been removed, exclusive of brushwood, not less than 1,000,000,000 cubic feet of wood, or on the average annually 25,000,000 cubic feet.

At present the annual cut is nearly double what it was fifty years ago, namely, a round 29,000,000 cubic feet, which is less than the annual growth, since the proportion of old timber is still allowed to increase, in order to bring the property into ideally normal condition. It is also interesting to note that while forty years ago more than half the cut was firewood, at present less than one-quarter comes to this inferior use, which is partly due to changes in economic conditions and uses, to be sure, but in part also to the skill of the forester.

Not to weary you too much with statistics, I may only add that last year the now 430,000 acres, more or less, with an administration that costs a round $445,000 and expends annually $180,000 additional for improvements, and after paying $450,000 to woodchoppers and laborers in harvesting the crop, etc., or a total outlay of nearly $1,000,000, net the Government (while wood in the forest, cut, brings 10 cents in the average per cubic foot) a round $2,000,000, or say $4.65, with 70 cubic feet cut, for every acre—good, bad, indifferent, young growth and old; and 60 cents net for every cubic foot of wood, while the stock of standing timber is increasing.

That is forestry in the spruce forests of little Saxony!

This, to be sure, is in a specially favorably situated section, in a state not larger than Connecticut, amidst thriving industries, with a population of over 3,000,000 people. Yet even in less favorable conditions with larger areas management pays. Thus Bavaria, equal in area to Maine, with a population equal to that of New York, with its very mountainous territory, owning in her state forests somewhat over 2,000,000 acres of forest land, which cannot for various reasons be as intensively managed as that of Saxony, more than half of it in spruce and much on poor soil, with an average cut of 60 cubic feet per acre, increased the net revenue per acre in these forty years by over 70 per cent., the net income being $1.95 per acre, and that when the average price for wood is less than 70 cents per cord in the forest, cut, and 66 per cent. of the total wood cut is cordwood; when $185,000 is paid out for roads and their maintenance, and $145,000 for planting, and, altogether, the cost of the administration amounts to $3,880,000 or $1.80 per acre.

I hear some of you exclaim that this is all right for European conditions, but that such things cannot be done here, or in any country less densely settled and developed than Europe. It will astonish you to hear that the Dutch in Java, far away from the wood markets of the world, think that they can afford to pay from $4 to $14 per acre alone for planting teak trees, which is done by farmers who, in addition to the price of planting, have the use of the ground two or three years for agricultural crops.

Then there is India, where, under still less favorable conditions a most successful administration has been developed by the English. The first attempts at some rational forest management in India date back to 1865, when it became apparent that the rough exploitation would soon lead to exhaustion, but even to-day when more than 65,000,000 acres are reserved or under Government control, the administration of this vast property is only partially in working order, and hardly yet 12 per cent. is being systematically managed, while 30,000 square miles are under organized protection against fire. Yet in the face of constantly increased expenditure for fire protection, road building, amelioration and administration, as the reserved area increased, the revenue in twenty-five years, from 1869 to 1894, increased to just five times its original amount, being in the latter year over $4,000,000, while the expenditures have increased nearly three times, being for permanent cost of administration $4,500,000 and nearly $400,000 for surveys, boundary demarcation and other extraordinary expenses; and that while fuel was given free to many adjoiners, over 80,000 acres were planted.

The inspector-general of this vast forest administration says that the progress in organization alone accounts for the regularly increasing receipts. The product was 190,000,000 cubic feet of timber and fuel, about one-quarter timber, besides 150,000,000 bamboos and nearly 2,000,000 minor produce, there being large amounts of tan materials, caoutchouc and lac gathered. Sandal wood, ebony, padouk and other ornamental woods and teak, the only structural timber of value, form the main products.

Again I hear you say: "Well, that is the English Government that can do so." Listen to the words of the inspector-general of India. Speaking of the forest administration of native states, he says: "Progress continues satisfactory * * * from Mysore with its fully equipped department down to the smallest states of the Himalayas, where a few years ago it could scarcely have been anticipated that a native chief would to-day, acting on the advice of an occasionally inspecting forest officer, be able to point to his oak forest, being regularly worked as coppice, with standards with the dense young growth of six successive years, thoroughly protected from cattle and topping, and proudly talk of the revenue of $7,000 to $8,500, representing $1.50 to $2 per acre per annum on the area of his forest."

This is the force of example upon the poor Hindoo!

Now look at your own forest areas! What do you get from them and what do you or can you expect from them after the virgin growth has been removed? What knowledge do you apply to manage this part of your most valuable property? What is its future? Who of you even knows what area you should have under management to supply your mill continuously?

You are cutting simply the accumulations of nature without any reference to what the future brings. You are cutting them to the smallest size that you think it will pay you to move out of the woods. Sometimes an uncertain feeling, that perhaps it pays better to leave the smaller trees, largely old runts, and come for them at a later time when they are bigger, prompts you to leave more, but I doubt whether any one of you has ever seriously considered that merely by properly regulating your cuttings you could, without curtailing your final harvest, reproduce a young crop and keep your property in ever-improving, revenue-paying condition, by employing a regular trained forest manager. Management of forest property there is none!

Look at the manner in which our woods have been and are even now exploited! First comes the lumberman, who only sees white pine; he makes his roads, builds his shanties and mills. When he has cut out the best and his roads are grown up to wood and washed out, his shanties broken down, there comes another who only wants tulip, poplar, or walnut, or oak, or some other one kind, and he builds new roads, new shanties and so on, each one going to the expense of rigging up anew, each one creating a waste left in the woods which might have answered some purpose other than his own. It is only lately that a division between the lumberman and pulp man is made here and there, the pulp man taking the inferior material and cutting the better logs to lumber. More such management at least is needed.

Just as the mining industry only thirty years ago was carried on in an empiric way without scientific basis or direction, while now well educated assayers and superintendents are employed everywhere, so the time will come when every owner of the forest property will have learned that there is such a thing as forestry, which requires technical training, and which can increase the product and property of the forest area far beyond the unaided efforts of nature left to itself.

There is one point more I wish to bring out which is suggested by the published remarks of one of your members, which were as follows:

"* * * At no distant date, when the increased cost of wood to foreign mills reaches a point which it is certain to do soon owing to the pronounced stand being taken in those countries against the indiscriminate cutting of wood (on account of its relation to the water supply and power of their rivers) we shall be able to cultivate a foreign trade in American pulp and fibre which shall be both permanent and profitable."

This is, indeed, mistaking the situation, and in the light of the above statements from Saxony is evidently an unfounded conjecture. While in this country people may well be alarmed by the enormous growth of the wood pulp industry, which is slashing the forests even more closely, and hence wastefully, as far as considerations of the future are concerned, than the lumber industry; in Germany the foresters welcome this industry with delight, for they now can sell to better advantage the inferior parts of the trees which formerly were good only for firewood, and still more advantageously they can dispose of the material that comes from the thinnings of the young growth, which from silvacultural reasons were highly desirable but had often to be omitted because there was no sale for the material. It is the offal largely which is given over to the pulp mill, the better parts being used for better purposes. Besides, Government control of private forestry has become less stringent, not more so.

No, gentlemen, whatever other factors may help you to find a foreign market, there is no hope to increase your exports on the supposition that the forest owners of Germany will spoil their well-established, profitable business of wood growing. The only hope is in managing the first end of your business, that upon which the whole existence of your mills is based, better than hitherto, and utilizing the forces of nature and the greater fertility of your soil and climate to outdo the German forester; in other words, by applying forestry.

SUPPLIES OF PULP WOOD IN WISCONSIN, MINNESOTA AND MICHIGAN.

The lumberman and the wood pulp manufacturer will have to divide the supply of the spruce, pine and hemlock material, while balsam, fir, tamarack and poplar remain mainly for the use of the latter.

There are no absolute statistics in existence, but we can arrive at a general idea of the possible supplies on hand by various calculations and by the use of such data as are in existence.

For Michigan the Commissioner of Labor reports, in 1897, 2,250,000 acres of standing pine and hemlock. For the Upper Peninsula we are justified in increasing this area by figuring as follows: Of the area of 12,0000,000 acres, fully 10 per cent. is swamp and probably 40 per cent. is cutover land, leaving about 50 per cent., or 6,000,000 acres in woods, from which, however, the white pine is mostly removed. For the Lower Peninsula such calculation is not practicable, and we have to rely upon the reports of the Commissioner of Labor, adding another million acres; assuming on this acreage an average crop of 3,000 feet per acre for pine and hemlock we would have 20,000,000 M. feet. To this we may add for pulp wood, including tamarack, spruce, balsam and inferior pines and hemlock, 12,000,000 cords. For poplar we have no data, but the Southern Peninsula must contain large quantities.

For Minnesota we have the Chief Fire Warden's estimate by counties, which credits 20,000,000 M. feet B. M. of pines, spruce and tamarack to the State. If we take the wooded area at about 13,000,000 acres, take off for swamp and open area or cutover lands 4,000,000, we have 9,000,000 acres well wooded, which would mean for that State 4,000 feet per acre, or a round 36,000,000,000 feet of white pine besides 10,000,000 cords of small material.

Hemlock is entirely wanting, and of spruce we may not count on more than 2,000,000,000 feet, or 4,000,000 cords, twice what the Fire Warden's estimate, above referred to, gives. Two million cords of balsam fir and 13,000,000 cords of tamarack will add greatly to pulp wood supplies.

For Wisconsin we can speak with more confidence and certainty, for a very competent agent of the Forestry Division has just canvassed the State thoroughly by personal inspection and otherwise.

He reports that poplar occurs only in small quantities, not worth considering. Spruce occurs scattered chiefly in swamps and the humid eastern parts. Not only does it occur scattered so that no large logging operations are practicable, but it is small, generally under 12 inches in diameter and under 60 feet in height; 800,000 cords might be culled altogether. Balsam fir also is never large and never abundant, although widely distributed; not more than 700,000 cords may be counted on. Hemlock seems to be on hand in greater quantities than is usually believed, growing on all clay and loam areas of the eastern humid portions, prevailing in many places though wanting over large tracts. It may be estimated at 7,500,000,000 feet, with 10,000,000 cords of small material. Tamarack may furnish 1,250,000,000, fit for piles and piling, besides 3,000,000 cords of pulp wood. Finally, white pine shows by a close canvass 16,500,000,000 feet standing, to which at least 5,000,000 cords of small material may be added for pulp purposes.

Putting these figures together we have an aggregate of a round 80,000,000,000 feet of saw timber in which lumber men and pulp men have an equal interest, and, in addition, a round 60,000,000 cords of pulp wood alone.

The cut of lumber last year was 6,250,000,000 feet, pointing to the capacity of that business to use up the supplies in little more than twelve years, while the pulp mill capacity reaches as yet hardly 450,000,000 pounds, or a requirement of a round 300,000 cords, which if the mills used only the cord wood reported, would show an inexhaustible supply, provided no increase in capacity, no fires and no competition for the supply from other consumers occurred.

How to Apply Forestry to Spruce Lands.

BY AUSTIN CARY, M. A.

Gentlemen—The subject assigned to me is forestry in actual application to the spruce lands of New England.

The wild lands with which I have more or less personal acquaintance are those of Maine and northern New Hampshire. Of these, the westerly ones are as a rule the more valuable, partly because they are nearer to market, no doubt, but mainly because they possess in the run a heavier stand of timber. The mountainous region of northern New Hampshire, at the head of the Connecticut, the Merrimac, and the Androscoggin, is the core of the natural spruce land of New England. Mr. J. A. Pike, of Berlin, N. H., before his death the best posted man on a large portion of this territory, set its average stand of spruce in the natural condition at 10,000 feet. East of that, across the Moosehead region, in Maine, and to the New Brunswick line, the average stand of timber grows lighter. A hundred millions of spruce per township is considered a large yield in the region of Moosehead—about 5,000 feet per acre. Eastward, on the Penobscot and St. John, when men are asked about the average natural stand of timber they are more apt to mention 3,000 feet than any other figure. This shrinkage in the stated stand from west to east is due partly to differences in methods of measuring and estimating timber and to varying degrees of closeless with which land is cut. Much of it, however, is to be attributed to actual difference in the timber stand. Spruce to the west runs both larger and thicker than it does to the east. Merchantable spruce timber, too, stands on a larger percentage of the land.

One consideration will go far to explain this relation in timber stand. It is altitude above sea level. The stand of timber increases from east to west; so does height of land above sea. The higher land on the line between Maine and New Brunswick is about 500 feet above sea; Moosehead Lake is 1,023 feet; the upper lakes of the Rangeley system lie at 1,400 to 1,500, while the average elevation of the mountain district of New Hampshire is still higher. That is to say, forestally speaking, spruce in New England is a tree of the high altitude, and the rough climate which naturally goes with it. The lower lying lands, including southern New Hampshire and southwestern Maine, have little of it.

Within the region of its distribution,[1] spruce stands in a great variety of ways. Comparatively seldom does it stand in pure groves. Fir, for one thing, though generally of very inferior size, is almost universally associated with it. Then the hard woods native to the region almost always make some degree of mixture. On the better lands, the easy and better soiled ridges particularly, the mixture is apt to be strong, even going so far as to amount to replacement. In these mixed lands, however, are found the very largest and finest of our spruce. Of the hard woods native with us yellow birch[2] is most extensively found, commonly accompanied by beech and maple.[3] On poorer sites, however, these latter go out; and sometimes on exposed mountain slopes, particularly where timber is short and open, the former gives way to its hardier relative, the white birch.[4]

These three species—spruce, white birch and fir—are against cold and exposure the stayers. Together, they mount as far as there is any soil toward the highest summits of New England.

Again, there are stands which, though seldom pure, are mainly and characteristically spruce. These occur most frequently on steep mountain sides, and on very rocky and poor soiled flats. Sometimes the timber is thick and heavy—it is often a surprise to see how little soil suffices to produce a magnificent stand of spruce; sometimes, due to extreme exposure or to bad drainage, the timber is small. Thick spruce and fir growths, in which the trees never reach a larger size than 12 or 14 inches on the stump, yet valuable for the large amount of wood per acre which they possess, are a not infrequent feature of our best timber lands.

The variety in species and form, moreover, is accompanied by diversity in age. Throughout all varieties of stand in which spruce occurs almost always are trees of every age and size mixed together.

Each single acre of forest land, therefore, has its peculiarities. On each is exhibited a multiplicity of facts and relations, all of which are of importance; all of which, if we are to make the most of our forests, we shall have to learn to take into account. Soil, its composition and drainage, determines the rate of growth of trees. It affects their health also, and limits the size which on any piece of ground they can attain. Thus on a piece of good land in our forests a spruce tree cannot be considered fully grown unless it will scale 400 to 500 feet, while on other ground trees 12 inches or even less in stump diameter, may be the best that you can ever expect to gain. The lay of the land is another matter of manifold concern. To us it is of particular concern from the fact that our spruce, with its shoal rootage, is especially liable to windthrow, from which the shape of the land may largely protect it. Undergrowth again may be of great importance. For instance, in some portions of our New England spruce woods the dwarf maples[5] and hobblebush[6], which are the usual undergrowth, seem so abundant and so favored by the soil that after a cut they cover the ground stripped with such density as to exclude other species. Such facts as that vary greatly with locality. They escape commonly undetected, yet they strongly affect, from the point of view of steady spruce production, the adaptability of different tracts of land.

Each acre of forest land, too, contains trees of different species, and some of these on the lands we are considering are utterly without value. Further than that, situated as they often are in competition with the spruce which you do desire, they are a detriment and a drawback to the land. Take the big scraggy yellow birches for instance, the most common feature of this nature in our heavy spruce lands, where they are generally of utterly worthless character. They overshadow small growth, they break off the tops of young trees that get up into their limbs, making them forked or stubbed. They furnish seed to supply spruce with its evenest competitor. With these facts perhaps you are already familiar. If so, you must have thought of a remedy. Forestry applied to these lands certainly will kill off these birches, and a thing which it seems to me any of you could do, with very little expense, to increase the growing power of your lands is to girdle a lot of them.

[1] Picea nigra.
[2] Betula lutea, sometimes with lenta.
[3] Species according to location.
[4] B. papyracea.
[5] A. Pennsylvanicum and spicatum.
[6] Viburnum lantanoides.

ILLUSTRATION.

In a New Hampshire forest note of the following facts was taken: A large forked yellow birch had the crowns of three pulp-size spruces locked in its branches; while a larger tree, 15 inches in diameter, had pushed its way through. Underneath, or near by, stood four spruces between 6 and 10 inches in diameter, and two smaller ones. All these would have been greatly helped by the death of the birch.

Then as to the spruce themselves, the condition of different trees and the relations which subsist between them. Trees, dead of old age, stand on most acres of virgin land, and with them go others past their prime, shrinking in quality every year. Such trees, if they are to serve any useful purpose, should, as soon as possible, be cut. Next comes a proportion of poor trees, such as are diseased, deformed, or that through dense and greater prolonged shading have lost their vitality. These may be of any size. Having, as a rule, some value to cut, they are not such trees as we should most desire to let grow. Then there are the big trees oppressing the little ones. The big trees are heavily crowned trees, big for that very reason. As one tree overtops its neighbors and gains access to increased light and air its foliage thickens up, its limbs lengthen, it crowds and covers over the young growing stock in its vicinity. Thus a big tree may overshadow a whole patch of little ones a foot or a few feet high. A half-sized tree may be wedged in between others, long and slender in shaft, and with thin crowns. Such a tree, if you suddenly relieve it of all support from its neighbors, is particularly apt to blow down. Here may be a grown tree overhanging half a dozen struggling ones a good deal smaller. If we were cutting here but conservatively, with a view to growth, we should take that big tree out, and you see that if carefully done we should leave ample stock to replace it. Not always, however, is the stock of young growth thus amply sufficient. Sometimes, for instance, a big spruce stands isolated in a piece of hard woodland. Such a tree so situated is an outpost in the lines of the enemy. Keep that fellow for seed supply. Perhaps if you look closely you will already see signs of his work. His retention is the main hope for the future of spruce for rods around.

Gentlemen, I didn't plan to speak of cutting so early in this address, but in describing the features of forest land, as nature gives it into our possession, I have been led to it almost of necessity. A strange idea it may be to you, but the virgin forests of New England, from the point of view of permanent spruce production, really need to have cutting done upon them. Cutting is needed to save wood from decay. It is also needed to put the land in better growing order. If we could go together for a short trip in those forests, you would see at once, and clearly, how it is possible to do here what, as has been shown you, has elsewhere actually been done—improve the natural condition of land and increase the rate of its growth of timber.

All of these ideas will be rendered clearer by record of the trees on a sample half acre notes of which, collected in the woods, in the employ of members of this association, are appended. After a score of the trees and comment on their condition is noted the treatment in the way of cutting, which we may say really needs to be done to put the land into best growing order. The half acre is a heavily timbered one from northern New Hampshire. It possesses some 8,000 feet of spruce, large and small, and the notes show that about 3,000 feet could be taken from the land in the shape of trees that are over-ripe, or else are impeding the growth of young timber. If these could be taken away, and in addition, due deference being paid to wind protection, about a dozen worthless birches could be killed, the land would really be in much better growing condition.

The question next arises: To what extent does lumbering, as now practiced, carry out the purpose of forestry in preserving and promoting the growing power of the land?

Most of you are doubtless best acquainted with pretty systematic and thorough methods of lumbering. You perhaps have bought timber land on an estimate of the spruce timber standing upon it, and you have gone in and taken the spruce that you paid for. That has been the sum of it. You have employed sharp, energetic men, and told them to cut the land clear. Perhaps you have had virgin timber running 10,000 feet to the acre, and of it, if fairly systematic, you may have left 1,000. That is very loose work in comparison with some I have seen, where it appeared that of the total amount of spruce wood, big and little, naturally standing on the land, operation had left alive but 1 per cent. But to take into account only the ordinary degree of thoroughness, you have, to sum it up, taken all the grown timber from the land, all the half-grown, and, though they may have paid you no stumpage over the cost of handling, many of the ungrown striplings as well. That, of course, is what up to this time you have meant to do, but our business to-day is to study the operation from the point of view of future growth. What can you count on for the future? How long before you can go onto that land again for another crop? How much small timber is there left, and what shape is it in to grow? What kind of new growth has cutting started into existence on the land? To answer these questions notes of another sample area will help us. It is a half-acre, cut over ten years ago, in the heavy spruce lands of New Hampshire.

The first inference I will draw in relation to these facts is that land like that here described is in shape to grow effectively of spruce wood in board measure per acre

somewhere about 50 feet per year. That, gentlemen, understood as representative, and taken in connection with the area of our spruce-bearing lands, is a very significant figure. However, I am not to apply it in that way. We will rather turn our attention to the condition of the trees of which the stand remaining is made up; see how they are fitted to go on and attain that growth which we now realize to be an object. See what we get from this representative area.

HALF ACRE OF HEAVY SPRUCE TIMBER IN NORTHERN NEW HAMPSHIRE.

SPRUCE.

No.	Diameter Breast High. Inches.	Total Height. Feet.	Condition.	Treatment Recommended.
1	14.5	60	A fair tree	Cut. Frees Nos. 2 and 3.
2	10.5	40	Partly free	
3	8.5	50	Partly free	Kill the birches
4	9.5	45	Between two birches	Kill the birches.
5	7	30	Under birches	
6	8	25	Under larger trees	
7	7	35	Under larger trees	Cut. Frees 6, 7, 9 and 10.
8	20	75	Grown tree; over others	
9	8	40	Thin crown; crowded	Kill the birch.
10	10	80	Top in a birch	
11	13.5	60	Partly free; growing	Killing a birch will help.
12	10	60	Partly free; growing	Kill the birch.
13	14.5	55	Top in a birch	Kill the birch. Cut this.
14	17	60	Top in same birch	Kill the birches.
15	7	35	Under birches	
16	21	80	Heavy crowned, but impedes none	
17	16.5	70	Thriving finely	Cut it. Frees 19 and several smaller.
18	25	90	Old, seamy tree	
19	7	30	Thin crowned, under	
20	17	75	Good, growing tree	
21	8	30	Under 20 and 22	
22	16.5	75	Fairly thrifty tree	
23	6.5	30	Thin; under others	
24	9	30	Stubbed	
25	9	50	Fairly thrifty	
26	8.5	45	Less thrifty	
27	14	65	Open, thriving tree	
28	20	80	Heavy crowned, grown tree	Cut. This helps 5 small trees.
29	6.5	30	Under others; thin	
30	6.5	30	Under others; thin	
31	10	50	Fairly thrifty tree	
32	16	70	Thrifty tree	
33	10	40	Free and fast growing	
34	11	45	Stubbed by a birch	
35	14	50	Stubbed by a birch	
36	7	35	Under a large spruce	Cutting will free.
37	6	40	Very thin crowned	
38	11	55	Fairly thrifty	
39	7	35	Under a birch	Kill the birch
40	20	70	Grown tree; over others	Cut. Will free several.
41	8	40	Between 40 and 42	
42	20	80	Little impediment to others	
43	14	40	Stubbed by a birch	Cut. Helps several smaller.
44	9.5	55	Fairly thrifty	
45	11	55	Fairly thrifty	
46	9	45	Top in a big birch	Kill the birch.
47	10	45	Top in same birch	Kill the birch.
48	9	45	Fairly thrifty	Cutting others will help this.
49	10	50	Fairly thrifty	Cutting others will help this.
50	14	60	Thrifty tree	May be cut to free 4 smaller.
51	14	65	Thriving tree	
52	15	70	Oppressed	
53	9.5	50	One-sided crown	
54	14	70	Thrifty tree	
55	12	55	Thin crowned	
56	13	70	Thriving tree	
57	14	60	Fairly thrifty; impedes 3 smaller	
58	15	70	Thrifty tree; over others	
59	13	60	Thrifty tree	
60	28	75	Fully grown	Cut. Helps many small
61	10	50	Crown compressed	
62	8	50	Crown compressed	
63	8.5	50	Crown compressed	
64	19	85	Good, thrifty tree	
65	12	65	Good, thrifty tree	
66	14	65	Good tree, thrifty; impedes 4 smaller	
67	13	65	Thrifty tree	
68	9.5	55	Fair tree	
69	7	30	Thin crowned	
70	11	45	Thin; under next	
71	23	75	Grown; impedes 3 smaller	Cut.
72	6	30	Thin crowned; shaded	
73	6.5	40	Thin crowned; shaded	
74	7	30	Under a birch	Kill the birch.
75	7	30	Under same birch	Kill the birch.
76	10	50	Under a birch	Kill the birch.
77	11	45	Fairly good tree	
78	8	35	Top in a birch	Kill the birch.
79	7	35	Under a birch	
80	19	80	Grown tree; impedes several	Cut it.

Summary of Spruce.

Saw-log trees over 12 inches on the stump, 36; about 7,000 feet B. M.
Pulp spruce (smaller, down to 6 inches breast diameter), 44; about 1,000 feet B. M.
Should be cut to aid growth, 10; about 3,000 feet B. M.
In addition there are on the area, between 3 and 6 inches breast diameter, 16 trees.
Smaller spruce (50 being in one bunch), 300 trees.

OTHER SPECIES.

Of *fir* there were on the ground 3 trees larger than 6 inches breast diameter, 11 between 3 and 6 inches, and several hundred smaller.

Of *maple*, 3 trees stood on the area and a bunch of small ones.

Birch, mainly white birch and entirely worthless, as follows:

Diameter.	Relations.
28 inches	.....Impedes 4 small spruce.
16 "	.....Shields 3 spruce of pulp size.
12 "	.....Impedes 3 little spruce.
12 "	.....Shields but one spruce.
17 "	.....Stubs 2 spruces, shields 2 others, also shades 2 patches of little spruce 1 foot or so high.
15 "	.....Impedes 2 spruce.
18 "	.....Impedes 5 spruce.
15 "	.....Impedes 1 spruce.

ILLUSTRATION.

HALF ACRE HEAVILY TIMBERED LAND IN NORTHERN NEW HAMPSHIRE CUT THROUGH TEN YEARS AGO.

Possessed, besides trees scored, a good many small firs, 10 large birches, with several smaller ones; also a few maple and beech. Has also 12 spruce between 3 and 6 inches diameter, and about 100 smaller spruce, being better than most land about in these items.

SPRUCE STANDING.

Breast Diameter. Inches.	Total Height. Feet.	Condition.
10	60	Stands open.
8.5	50	Thin crowned.
8	35	Under a big birch.
8	25	Stubbed by hard woods.
15	70	Poor tree.
11	50	Thrifty tree.
7	30	Under a big birch.
11	30	Stubbed by hard woods.
11	40	Under a birch.
10.5	40	Top in limbs of same birch.
10	50	Poor crown.
17	75	Poor, crooked tree.
7.5	35	Crown thin.
12	60	Fairly good tree
10	50	Good tree.
10	50	Top in a birch.
7	30	Rapidly growing.
7	30	Under a big birch.

Total, 18 trees; about ½ M.
Of these there are of vigorous trees left in good shape to grow, 5; damaged or impeded by hard woods, 8; deformed trees and trees crowded in the original stand, and therefore in poor shape to grow, 5.

Of eighteen trees, more than 6 inches in diameter, standing upon this half acre, five are thin-crowned trees, oppressed in the original stand, which, so severely changed in their conditions, have not yet in the ten years succeeding the cut regained vigor. Eight are either deformed or impeded by hard woods. Of the eighteen, only five are vigorous trees left in good shape to grow. Plainly, it is the poorest of the natural stand that you have left—left it for that very reason. It is not in good shape to grow, and it can produce, as a matter of fact, very little. It will perhaps be fifty years before you will care to come back over that land. At 100 years the crop could hardly fail to be inferior to the original.

Neither does a sample acre like this exhibit all the loss and waste that occurs. It does not, in the first place, exhibit the ruthless smashing of small trees that accompanied the cut, a source of loss which increases with the closeness of the cut and the thickness of stand. If you could take all the grown trees and leave all the small the resulting condition would not be a bad one, as comparison of numbers in our sample half acre shows. As a matter of fact that cannot be done, because in cutting and getting out the large trees you destroy, in any heavy stand, a large proportion of all the rest. This sample tract, moreover, does not exhibit the blow-down that so often follows cutting, a source of loss in our spruce woods which very few adequately appreciate. It does not tell us of the trees that on exposure to direct sunlight scorch, and finally die. Those spindling spruce I have spoken of, with thin crowns grown in shade, and a root development to match, valuable as they are if gently handled, can withstand often no such harsh treatment as this. These evils are particularly manifest on land where spruce forms the bulk of the growth. Generally, on such land, a large part of whatever small stuff may be left blows down, and the remainder, loosened at the roots, or overhead by the sun, draws out a pitiful existence. On such land as that more value attaches to the brand new growth or the very little spruce that were undergrowth in the original stand. These, indeed, according to my observation, will generally persist. You cannot, however, expect them to yield you practicable lumber in much less than a hundred years.

What now of the new growth following the cut? That matter perhaps seems of small concern to you, but you will admit at once, when it is pointed out, that if lands are permanently to bear spruce the stock of young growth must constantly be replenished. That is an essential part of good forestry, and when we actually attempt that in our spruce woods every operation will have to be done with due reference to it. How does hard cutting affect it? Here we tread on difficult ground. To understand clearly the fact of the matter, we shall have to refer to a principle in tree biology which Dr. Fernow has elucidated, the dependence of trees upon light. Our spruce, in this relation, shows no less hardihood than in respect to its requirements on temperature and soil. The way in which it survives and outlasts oppression is such as to win for the tree, when understood, admiration and regard.

Well-grown spruce in our forests are of an average age of more than 200 years. Of that time, however, but a small portion may have been passed in opulent conditions. Young spruce, as a rule, start in partial shade, under thin cover or little holes in the stand; they grow in early life but slowly, and only by long persistence live to outlast the oppression of the trees around. Often their battle is prolonged through many decades. Sometimes spruce no more than 3 or 4 feet high represents as much as 50 years of struggle. At 100 years of age, the average spruce in our forests is perhaps but 6 inches in diameter, containing only about 4 cubic feet of wood. And yet they retain vitality. The history of grown trees proves it. Study by the rings of the trees cut in our forests shows us that the bulk of our timber has come to us in that way.

ILLUSTRATION.

HALF ACRE BURNT OVER 108 YEARS AGO.

SPRUCE.

Breast Diameter—Inches.	Number of Trees.
14	2
12–14	8
10–12	18
8–10	46
6– 8	36
3– 6	36
	146

OTHER SPECIES.

Breast Diameter. Inches.	Number of Trees.		
	Pine.	Poplar.	White Birch.
24	2	..	..
16–18	6	..	..
14–16	2	6	2
12–14	8	6	..
10–12	4	2	2
8–10	8	..	6
6– 8	..	..	8
3– 6	..	..	4
	30	14	22

General height of spruce, 60 feet. Other trees, much higher as a rule, impede the spruce but little.
Spruce, 146 trees, 1,740 cubic feet; probably about 4 M on close cut and scale.
Other species, 66 trees, 3 840 cubic feet.

Examine after this the vicinity of the sample half acre presented. It was in mixed, but heavily timbered, land, where bunches of heavy spruce alternated with areas covered largely with hard wood. The bunches of spruce were cut clean, what was not used being smashed down, so that large gaps were made in the cover of the land. The scattering spruce outside could not be cut so thoroughly, and those left, with the hard woods, still formed a thin cover. Now note the difference in new growth. The gaps after ten years were densely filled with a variety of deciduous growth. Part of it was of sprout origin, come on from the original undergrowth, which, cut off or bruised in the lumber operation, and thrown open to the full light of the sun, had shot out new heads more numerous than those of the fabled hydra. Wherever these had left a gap, cherry, with birches and maple, had filled in; so that ten years after the cut, on land which showed by the stumps that it had once possessed the very cream of the timber, one could go for rods through and under a dense growth of these forest weeds and see on the passage hardly an evergreen tree. It was on other portions of the land, in the parts that originally had less spruce, where there was most spruce reproduction. Just think of these facts, gentlemen. They are worthy of attentive consideration. On those portions of the land where in the original stand there was most spruce, there you have left least, and the least capacity for production.

The example here used is a somewhat extreme one. It is adduced to illustrate a principle. Mixed land is seldom so favorable to forest weeds as it is here, while on natural spruce land the case of spruce reproduction is as a rule vastly better. Oftentimes in the woods the reproduction of spruce seems free and abounding. It would be hard to check it. But the principle I believe to be true, and if so it is certainly of great importance. Spruce germinates and gains its early growth readily under a shade. Big gaps made in the cover are apt to fill up with its competitors.

Thus you see, gentlemen, that from consideration of still another factor in the life of the forest we arrive at the same conclusion previously gained as to the usual method of treating the land. Condemnation of hard cutting is indeed the keynote of this address. For its bearing in every direction on the productiveness of the forest, we must condemn it. By hard cutting I mean any cutting which takes systematically two-thirds or three-quarters of the timber standing on the land. We must include in it such cutting as would aim at leaving of the normal stand of spruce in New Hampshire and Maine only the trees 12 inches or less on the stump. There are circumstances in which the bad effects of hard cutting are mitigated; there are regions where without an entire reversal of policy the very hardest cutting is the only practicable policy to pursue. In general, however, it is incompatible with the generous production of our spruce forests. Hard cutting not only takes the mature timber from the land; it takes away or destroys most of the young growth, on which depends all prospect of reaping another crop within the next fifty years. In general, it helps to throw the ground permanently over to the possession of other species. No wonder, gentlemen, that further thing is true with which you are all familiar, that it wipes out the market value of your land.

On the other hand, there are facts and conditions to be observed in our forests today that teach us much as to the lines of better management, and define our ideas as to what its results will be. The best field for the study of these phenomena is in those regions where lumbering has been carried on longest. The extensive use of spruce for paper making in Maine began within twenty years. It is only within the last fifty years, indeed, that spruce for any purpose has, in large amounts, and on the larger rivers of the State, been cut. Previous to that, however, there was for many years an extensive output of pine. The distance to which pine was pursued before men began to turn spruce to account is truly remarkable. Fifty, a hundred, even two hundred miles the lumbermen of half a century ago went off to the wilderness, hauling supplies on ox sleds, living in camp all winter, and coming down with the drive in the spring. So far from market, with the price they got, they took and they could take only the largest and soundest trees in the forest, and the clearest parts of them. But the main point for our present purpose is that as the pine in the backwoods was seldom thick or pure, generally a good deal scattered, in fact, standing in groups and singly in stands made up mainly of other species, the cutting, though reckless enough, was light, and opened up the cover only in little spots and patches. Now pine, in contrast with spruce, is a light needer, and in the little gaps and openings which the early cutting made it was not generally the pine which came on again, but where spruce was on the ground, and conditions were favorable, it was spruce instead. The upgrowth of spruce largely occurred, no doubt, through the oncome of spruce undergrowth already present, but much of it also was due to new seeding. At any rate, by one means or another, much of the territory once cut for pine now has a great amount of thrifty young spruce, which if not yet of marketable size, has great promise for the future.

ILLUSTRATION.

SPACE 25 x 50 FEET (ABOUT 1-30 ACRE) FROM OR CLOSE TO WHICH THREE LARGE PINES WERE CUT FIFTY YEARS AGO. NATURAL SPRUCE AND PINE LAND. MOOSEHEAD REGION.

Breast Diameter. Inches.	Number of Trees.	
	Spruce.	Fir.
14	1	..
12	2	..
11	1	..
9	0	1
8	3	2
7	2	..
6	5	..
5	4	1
4	6	..
3	15	..
Under 3	13	..

Total, 54 trees, about 175 cubic feet. General height, 40 feet. Cover so dense that there is no undergrowth. Several little spruces are dead.

Then men began to saw spruce and market it, and so they went back over the land again, striking for the thickest and biggest of the timber, taking at first such trees perhaps as would scale three or four to the thousand, and leaving everything smaller, with the regions of thin timber, to stand. Later on the cutting was to a lower standard, and in some regions once lightly treated finally became severe. Elsewhere, however, nothing but good-sized saw logs have been cut, and there are great areas in Maine where those tactics are pursued to-day. For fifty years or more some of those townships have been cut on in a moderate, unsystematic kind of way. One man has cut till he got the best chances logged. Then the same after a few years, or some other man, perhaps in his old works, has gone on and cut more. Half a century these tracts have been cut on, they have yielded beyond all expectation, and yet they are not exhausted. In fact, there never has been a time when they have been worth so much to sell in the market as they are to-day.

I have no praise to bestow on the system of holding and management under which lands described have been operated. There are wastes and losses in it such as I hope those who are yet unfamiliar with them may never know. But I say that the history of those tracts, in the way they have yielded, in the advance of their valuation, in their actual timber condition as it may be seen to-day, contains a lesson for us as we study how to make the most of our remaining forests, that we might not from more distant examples so forcibly learn. The point is that the treatment of those lands was light, discursive and gradual. When men cut a big pine, with the road by which they got it out they made a mere scratch on the surface of the forest. There was no violent change in the conditions of trees about. No hole was made for the wind to get in. Trees standing about simply used the light and space to the quickening of their own growth, while young spruce seedlings, saved from the overbearing of forest weeds to which in a larger opening they would have been subject, took underneath possession of the ground. Again, when men came on for the biggest spruce, they did a very similar thing. They took a few trees here, and a few there—left the timber which was either thin or small. On a well-timbered acre they might take but a dozen or twenty trees. Here, again, young growth was opened gradually, and not with violence. The ground was kept right for new seeding, and there was no chance for wind. They did, in fact, in a rough way, just what for our sample half acre we pointed out should be done to put it in growing order. The small spruce gained crown and grew up, little ones came on to take their place, and finally when the lumberman comes onto the land with his sweeping methods, as he has often of late years done, he finds sometimes such a stock of vigorous growing spruce of all sizes, from smallish saw logs down, that he couldn't obliterate spruce from the land if he tried.

Illustration of most of these statements is found in the sample areas of cut-over land, notes on which are here given. The areas selected are from the Moosehead region, in Maine, on land which has been operated as I have just outlined. The first piece of land never had enough cut on it to thoroughly open it up for growth. Big spruce are holding back little ones, but the latter are especially oppressed and impeded by hard woods standing over them. If five good-sized spruce could be cut off that quarter acre, and in addition the worst of the impeding hard woods could be killed, the yearly growth of wood on that tract, as soon as the young trees have gathered themselves, would probably be half as much again as it is to-day. The density with which the ground was shaded was somewhat unusual. Only across one end, in the side light from a road, was there any undergrowth. The shade was too dense for young trees to come on.

ILLUSTRATION.

In a New Hampshire forest 8 spruce trees between 6 and 12 inches in diameter overshadowed by hardwoods were growing on the average an inch in diameter in 20 years. Six fairly well conditioned trees on the same ground averaged an inch in 8 years. Ohio is not an extreme example.

The second is a piece of ground which some twenty years before was cut too open. The spruce left were growing very fast—an inch in diameter every five years would hold for many of them. But they were so open, and their crowns were so long and heavy, that the greater part of the timber never could make desirable lumber. As to spruce reproduction, too, there is something to learn. There was on one end of the piece a bank of young spruce and fir a few feet high, covering an area of several square rods. Elsewhere, however, fir was much more numerous than spruce, while very much of the regrowth was deciduous.

The third area is most interesting and instructive. It was picked to show, as nearly as might be in natural forest, the ideal condition. It represents this the better because there is only a small mixture of anything else but spruce. Many years ago three pines were cut on the tract. At a later date men came and took thirteen spruce, these having been pretty well distributed. Across the half acre they cut one road. The result, viewed now at the end of twenty-three years, is singularly fortunate. Most of the small trees were set free and they are finely growing, though seldom one with a too long or bushy crown. The road mentioned, where the ground was left openest, had filled in with white birch and cherry, but elsewhere throughout there were little spruce in moderate but sufficient amount. It seems possible that this half acre has now more lumber standing on it than it had in the natural condition. If not, it certainly bids fair, if left a few more years, to acquire it.

On the basis of this example we can clearly and definitely illustrate the difference between forestry and lumbering. This half acre is just such ground as one of your lumbermen cutting pulp wood would delight to swoop down upon. He would get, perhaps, 6,000 feet off it, and he might leave it in shape to grow, say, twenty-five board feet per year. That would have to accumulate fifty to seventy-five years before you would care to come after it.

The forester, on the other hand, would use this piece of land much differently. There is, indeed, about a thousand feet of lumber on it which he would like to cut, in the shape of a few old trees, and also of imperfect ones, which are impeding their neighbors. He might even cut some of the larger of the other trees to make up a respectable operation. This would be under protest, however, for the trees, 12 to 16 inches in breast diameter on this tract, are just the ones which are producing most, right in the very height of their power of wood production. If the forester could have his way entirely, leave everything standing except the 1,000 feet I have mentioned, the half acre, as near as I can judge, would in the next fifteen years grow more than 2,000 feet of lumber. That, taken out carefully, in the shape of the largest trees, the rate of growth stated—150 feet approximately in board measure per year—the half acre should be able to permanently maintain.

ILLUSTRATION.

YEARLY GROWTH OF SPRUCE ON CUT-OVER SPRUCE LANDS OF KENNEBEC RIVER, IN MAINE. FROM 240 OBSERVATIONS.

Breast Diameter of Tree. Inches.	Yearly Growth. Cubic Feet.
7	.26
8	.33
9	.39
10	.45
1	.51
12	.56
13	.61
14	.68

THREE SAMPLE AREAS REPRESENTING LAND (1) TOO DENSELY COVERED TO GROW WELL; (2) TOO OPEN TO DO BEST; (3) JUST ABOUT RIGHT. MOOSEHEAD REGION.

AREA NO. 1.

Quarter acre of mixed growth, from which 8 spruce were cut 20 years ago, not enough nor wel

railroads was due simply to doing business on a larger scale by the introduction of more power, larger vehicles, and a road-bed amply able to carry them. The increased production of the blast furnace was due to increased size, to the hot blast, and to an increase in the supply of air.

The same progress has been made in paper manufacture. Our first impression of a paper mill is a long, low building, situated on a comparatively small stream, provided with a single paper machine, or, at the most, two, operated at a slow speed, the dryers being heated by steam from a single boiler of small size, and the whole business conducted by the members of one family. There were larger plants on larger streams, but they were practically aggregations of smaller ones. Gradually the output of single machines has been enormously increased both by increase in size and in speed, the latter having been made possible principally by greater facilities for drying the paper, the increase in the number of dryers being the most evident change, like the increased number of blowing engines in connection with the modern blast furnaces. Mechanical details have also been perfected, so that instead of a speed of 100 to 150 feet per minute it is now found possible to operate at the rate of 500 feet per minute on some classes of work, and obtain an output under favorable circumstances as high as 30 tons per day from a single machine.

The increased output has required a great increase in the steam plant of paper mills, and naturally manufacturers are continually inquiring whether economies cannot be secured in this branch of the business. It may be assumed generally, with perhaps special exceptions, that the incidental uses of steam, such as that required for bleaching, heating the buildings, etc., are independent of steam for power purposes, of small importance in comparison with the quantity of steam required for heating the dryers. It is assumed also that in general water power is available for all preliminary operations, particularly for operating the beating engines, but that it is desirable to operate the paper machine with steam power, which is steadier, while readily permitting desired changes of speed. As it is possible to operate an engine of sufficient power to drive the machine with steam used afterward to dry the paper, the cost of steam power is substantially proportioned to the quantity of steam required for the dryers, plus 10 to 15 per cent. chargeable to the engines, plus that used for incidental purposes about the mill for bleaching, heating, etc. If, in any case, a steam plant is required to assist the water power, it should be considered independently, though the first cost may be considerably reduced by constructing a single boiler plant and massing the engines at one location.

The speaker is informed that as the paper passes to the dryers it contains about 28 per cent. of solid matter and 72 per cent. of water, and that about 5 per cent. to 9 per cent. of water can be left in the paper after it is apparently dry, as it would absorb that amount from the atmosphere were it made absolutely dry. The latter percentage applies to the solid matter in the paper and is therefore only about (7 per cent. of 28 per cent.)=2 per cent. of the weight of the original wet fragile web which is conducted to the dryers. It follows, then, that 28 per cent. + 2 per cent. = 30 per cent. of the original weight remains in the finished paper and 72 per cent. —2 per cent. = 70 per cent. is in the form of water which must be evaporated. There must, therefore, on this basis, be 70÷30=2 1-3 pounds of water evaporated for each pound of paper produced. The evaporation takes place into the atmosphere and each pound of water evaporated at 212° carries off 212.9 thermal units of sensible heat above the zero Fahrenheit, and 965.7 thermal units in the form of latent heat, so that the total heat above zero carried off is 1,178.6 thermal units per pound of water evaporated. The water of condensation in the dryers should be collected and returned to the boiler at the temperature due to the pressure. For a pressure of 5 pounds above the atmosphere the temperature would be 227.1°. Allowing 2° for loss in transmission the feed water at a temperature of 225.1° would return to the boiler 226.1 thermal units above zero, so that the heat taken from the boiler per pound of water evaporated would be 1,178.6—226.1=952.5 thermal units, or for each pound of paper produced two and one-third times as much = 2,222.5 thermal units.

The absolute calorific value of the best bituminous and semi-bituminous coal is about 15,500 thermal units per pound of dry coal, containing a small percentage of ash. The calorific value of the better kinds of fairly clean commercial anthracite and bituminous coals varies from 13,000 to 14,000 thermal units per pound, or, say, 13,500 thermal units on the average. The calorific value of pea and buckwheat coals varies between 11,000 to 12,000 thermal units per pound, say 11,500 thermal units per pound on the average. The differences in calorific value of different coals are very great, and the proportion of the same that can be utilized in the boiler varies still more. Some of the bituminous coals contain so much volatile matter that the efficiency, or the proportion of the theoretical thermal value which can be utilized in practice, is less than that for coals not so highly bituminous. With grades of coal mentioned as having the highest calorific value, evaporations have been obtained as high as 10 and, in some cases, 11 pounds of water per pound of coal, corresponding to 73 to 75 per cent. efficiency for varying calorific values in the different cases. These results, however, have been obtained under experimental conditions and generally from boilers having very small, thin tubes not adapted for use in a paper mill. Economizers were also used in connection with these boilers. The best practical result which can be hoped for in average practice with commercial coal is about 9 pounds of water per pound of coal evaporated under actual conditions, and, with the cheaper grades of pea and buckwheat coal, only 7½ to 8 pounds evaporation will be obtained on the average. For mills situated near the coal regions, where the cost of transportation is low, the small coal can be employed to advantage, but when the coal is transported a long distance the transportation cost per ton of small coal is as great as that for the larger sizes, and the latter will generally be more economical at a higher price, though the question is one to be settled by the circumstances of each particular case. Assuming that the boiler plant is of a type above the average, that it is well managed, and that a good commercial coal is employed, we may, with hope of doing better under exceptional circumstances, assume an evaporation of 9 pounds of water at a pressure of 80 pounds from the feed water temperature of 225.1° above mentioned. Each pound of steam will then have derived from the fuel 989.8 thermal units, and for each pound of coal there will be utilized nine times this, or 8,908.2 thermal units, corresponding to 66 per cent. efficiency for an average calorific value of 13,500 thermal units, which shows room for improvement, but is difficult to obtain under the conditions of regular working. As we have already found that 2,222.5 thermal units will be required per pound of paper, on the basis previously assumed there will be 8,908.2÷2,222.5= 4.008 pounds of paper dried per pound of coal, or, in round numbers, the drying of each pound of paper would require one-quarter pound of coal if the steam were taken direct from the boilers. Adding one-eighth or 12½ per cent., as explained hereafter, for the reason that the calorific value of the steam will be reduced by utilizing the extra pressure to operate the machine through a steam engine, and again 10 per cent. for incidental uses of steam and transmission losses, the coal consumption should not exceed 0.3094, say five-sixteenths pound for each pound of paper manufactured. If we allow that some exhaust steam from the engine will be wasted at times, there should be at least three pounds of paper manufactured per pound of coal.

The general interest in the subject of reducing the amounts paid for drying the paper has raised questions whether or not the cost could be reduced by introducing direct heat in the dryers from incandescent fuel or gas, or if the heat could be transferred more economically from the fuel to the drying cylinders by any other medium than steam. The speaker thinks not. To be sure all the heat in the fuel is not imparted to the water in the boiler, but the losses are no greater and probably less than would be incident to any other form of furnace. It is evidently impracticable to build a fire in or under a drying cylinder. The difficulties in conveying away the products of combustion and in arranging the complicated flues required to reduce the temperature of the gases and impart the heat to the paper, so as to prevent a large escape of heat to the chimney, are insuperable.

As to other mediums of conveying the heat from the furnace to the dryers, hot water would be available and would be equally efficient with steam if properly carried out. Complicated passages within the dryers would be necessary if the cylinders were not entirely filled with water and in any case the weight would be very greatly increased, causing increased friction and, in case of accident, increased danger to life, as the storage capacity for heat in a mass of water is enormous. A man may safely pass his hand through a jet of issuing steam when he would be scalded instantly by a few drops of boiling water. Hot water is employed in greenhouses, and some of the better class of dwellings for heating purposes, simply because the large mass of water in the pipes prevents sudden changes of temperature, and, moreover, the heating can be done at a temperature less than that due to atmospheric pressure, so that a little heat can be obtained regularly in mild weather. None of these advantages apply in heating the dryers and in any event there would be nothing saved by the use of hot water, so we need not further consider this branch of the subject. The same objections that apply to hot water would apply to any other fluid. There only remains some indirect means of heating. For instance, gas could first be manufactured from the coal and then burned within the dryers, but, independent of economical reasons, one can see that great care would be required if the machine were stopped to prevent one part of the dryer becoming hotter than another. Moreover, constant care would be required to keep the quantity of gas burning in each proportioned to the work done therein, whereas with steam the temperature is as steady as the steam pressure and no part of the dryer would be unequally heated with proper drainage. Independent of these considerations the application of heat is indirect. Coal is first employed to generate gas, which is a wasteful operation, and then gas is to be burned, which requires for economy special burners with openings for the gas and openings for air properly adjusted one to the other and provision made so that heat will not be wasted by currents of air through the openings required to adjust the burners. The originators of such a scheme would certainly wish that they had some method of transmitting heat which would need little attention and maintain a constant temperature, exactly as is secured by the use of steam. We conclude, therefore, that the present practice is the best; that for every pound of paper a certain weight of water must be evaporated; that the fuel required for the same can be burned economically under a steam boiler and the steam transmitted with minor losses to do the work, the water of condensation being returned to maintain the supply of feed water. If our assumption to the proportional weight of water in the paper as it approaches the heaters be correct, there is no way to avoid burning at least one-quarter pound of coal per pound of finished paper for the simple purpose of drying such paper. The other allowances stated are subject to correction, according to the actual conditions at particular locations.

As a matter of interest, it may be stated that under peculiar conditions an evaporation of 20 pounds or more of water per pound of coal is possible instead of 8, 9, or say at most 10 pounds, which we have considered practicable in a paper mill. This high result is, however, only obtained by multiple evaporation, or an evaporation in series, in which there is first an ordinary steam boiler provided with a furnace in which fuel is burned in the usual way and with usual economy. In this boiler steam is generated at a high pressure and conducted to a second boiler in the form of a tubular heater in which the steam boils water and generates steam of a little lower pressure. This steam is employed to generate steam at a still lower pressure in a third boiler, the steam from the third generates steam in a fourth, and so on till the pressure is reduced nearly to that of the atmosphere. The water condensed in the first of the steam heated boilers is returned to the fuel heated boiler and does not affect the result. In all of the remaining steam heated boilers the steam delivered from either one is condensed in heating the next and the water of condensation withdrawn as distilled water, so that the aggregate evaporation may be as high as stated. Evidently this plan is not applicable to drying paper, because that must be dried under atmospheric pressure and, as the steam and vapor pass away, the heat is not recoverable. Possibly some metallurgical operation requiring the use of a large quantity of steam without pressure may some day come to light which will make the escaping steam a valuable by-product and thus indirectly reduce the cost of drying paper, but no such means are known to the speaker at the present time.

We call attention, however, to the fact that if in the manufacture of fine paper it is required to purify the water supply and the impurities are of a character that they cannot be removed by mechanical filtration after precipitation by chemicals, it is possible to use the steam finally supplied for the dryers, first at a high pressure to evaporate water in a steam heated boiler, perhaps repeating the operation, and finally to use the resulting steam to heat the dryers as at present when the water of condensation in the steam heated boilers could be used for the special purposes referred to. This possibility is mentioned more to interest the auditors and show the resources of various branches of engineering than to furnish the solution of any problem now confronting us.

It is, however, both practicable and economical to use the steam from the boiler, first for power and afterward for drying the paper and other heating purposes. This system is common in paper manufacture, but I find that some persons still doubt its economy.

In the operation of a steam engine the steam actually condensed for the work done is less than 3 pounds per horse-power per hour, and as in non-conducting engines 30 to 40 pounds of steam are required to practically produce a horse-power for one hour, it follows that not more than one-tenth of the heat will be abstracted in using the steam first for developing power, and that nine-tenths of the heat will be available for heating purposes and is as valuable, therefore, as if taken directly from a boiler at the same pressure. It has become quite common in cotton mills to use exhaust steam in the preliminary operations of dyeing and in manufactories of all kinds to use such steam for heating purposes during the winter. For engines where the whole exhaust is utilized for heating purposes it has become customary in some mills to charge 85 per cent. of the cost to heating and 15 per cent. to power. In our previous analysis of costs we have considered that 12½ per cent. is sufficient to charge to power, and this will still leave a fair margin for losses in transmission. Compound condensing engines, however, can be employed to furnish the power to drive the machine, for in round numbers one-half the cost of the steam used on the exhaust system for both power and heating purposes, but in water power mills where steam power is employed only to run the machine it would be necessary also to use live steam for the dryers. In such case the relative costs would be as follows: For exhaust heating, seven-eighths for heating and one-eighth for power, a total of 114.3 per cent. of the heating cost, whereas with live steam the heating would cost 100 per cent. and the power 50 per cent., so the saving due to exhaust heating compared with the use of the most economical engines to drive the machine with direct heating would be 100 (150—114.3)÷150=23.8 per cent. If, however, ordinary high pressure engines were used with direct heating the saving due to the use of exhaust steam would be fully 50 per cent. Again, however, if the whole or a large part of the whole mill were to be operated by steam power it would be possible to take steam for the drying cylinders out of the receiver between the two cylinders of a compound engine at less cost than to use a full exhaust system. This "bleeding of the receiver," as it is called, would in general not be practicable with a compound engine operating the paper machine only, as all the steam would be required for the dryers, making the engine practically non-condensing, as already assumed.

It follows, therefore, that very large economies can be obtained both theoretically and practically by using exhaust steam for drying the paper, and it may be added that any failures which have resulted in attempting to utilize this principle must be due entirely to the way in which the details have been carried out.

In this connection it will be of interest to state, in a general way, the means adopted to secure economy of steam in the large oil refinery of the Tide Water Oil Company at Bayonne, N. J., involving among other things the utilization of exhaust steam on an enormous scale. Though the business differs from paper making, very many of the questions involved are applicable in the operation of any steam plant. The present works represent the consolidation of several independent plants and occupy about half a square mile of territory. About 5,500 horse-power of boilers were originally installed in four boiler houses erected in different parts of the grounds and the consumption of coal for steam purposes was about 64,000 tons per year, independent of a very large quantity consumed directly under oil stills. The steam was used to operate engines in the paraffine and other departments, in the barrel, can, box and other factories; to operate a large number of steam pumps used to transfer the oil and finished products to different parts of the yards and to the docks for shipment; to press out the paraffine or wax in the heavier oils; to operate hydraulic presses for higher pressures, and to pump water in large quantities for cooling purposes, ammonia for refrigeration, etc. Steam was also supplied to several small plants for electric lighting. A very large part of the steam supply, however, was required for various heating operations connected with oil refining. The several superintendents and engineers were educated men of the highest order, and had been investigating the possible saving of steam by various methods. A copy of a paper by the speaker, showing the enormous consumption of steam in ordinary steam pumps, had been studied, and it had been considered desirable to replace many of such pumps with power pumps. Exhaust heating had been used somewhat, particularly for maintaining the temperature of the tanks in winter, and its more extended use had been discussed. The steam pumps of various sizes were scattered in all parts of the large area, some in buildings, others exposed in the air, and the length of steam pipes required to reach all the outlying points where power and heating were requiring was very great and caused a large condensation of steam. A prominent electric company had submitted a proposition to substitute electric motors to supply power at the different locations, and electrically operated pumps in place of the steam pumps. It was proposed to mass the high pressure boilers at one part of the yard in connection with engines of high economy, operating large dynamos to supply the electrical energy, the other boilers to be used to furnish steam for heating purposes. No agreement could be reached between the various engineers and directors of the company, and the speaker was called in consultation. It was found that a very large proportion of the steam was used for heating purposes and the large electric plant was not approved. A smaller electric transmission was recommended to reach various outlying points where steam had to be transmitted a long distance at a very great expense in condensation, independent of the power developed, since it was necessary in winter and desirable in summer to keep the pipes warm all the time, although the power was at many of the points only used occasionally. An extension of the exhaust system was recommended even if it became necessary to increase the back pressure, and it was urged that exhaust steam be used for all heating purposes, instead of live steam. As it appeared probable that more exhaust steam would be available than could be employed for heating purposes, it was recommended that special plants, with power pumps and economical engines, be erected at various parts of the grounds and particularly in the paraffine department. Without going into full details it is sufficient to say that the recommendations were adopted, and carried out efficiently under the directions of the superintendents of the company, and resulted in a saving of fully one-half the coal required for steam purposes, or 32,000 tons per year. One boiler house was entirely shut down, another partially so, and considerable saving in labor effected, so that the saving for the first year was upward of $50,000, after deducting the cost of making the changes. The greater portion of this saving was undoubtedly due to the use of exhaust steam, but the cutting off of small steam pipes running to the docks and obscure corners, and the use of an electric plant to supply power in these localities, had its influence on the comparatively small portion of the power operated in this way. A single three-phase dynamo erected alongside a large economical compound pumping engine, and requiring no additional cost for labor, furnished electric current for both power and lighting, and the three small lighting plants were dispensed with. The interest evinced by the large staff of intelligent engineers and superintendents, and their careful attention to the subject, moreover, secured, in consultation with the speaker, economies in arrangement of piping, in protection from radiation, and in the management of fuel, which had also an influence on the result. Before the changes the grounds were overhung by clouds of escaping steam. Now hardly any is visible. In comparison it seems like Sunday, or as if the work was stopped, whereas actually the output is fully as great as before. In so large an establishment there were very many details touched upon of great interest which it will be impossible here to recount, though it may be desirable to refer to some of the same in connection with further remarks it is proposed to make with special reference to the economical use of steam in the manufacture of paper.

The quantity of steam used in a modern paper mill is so large that great care should be taken in designing all the details of the steam plant. The principles to be employed are exactly the same as in designing the steam plant for a large electric lighting or power station, or for any large manufactory. First, in order to save labor and secure efficiency, it is desirable that the boilers be massed together, and the engines also, so far as practicable. With comparatively small plants, the boiler room can be arranged at right angles to the engine room, so that the engineer on duty with the engine can through glass doors have a supervision of the fire room and secure the efficiency due to having all the work done under the control of one head. For larger plants the boilers are generally arranged in a separate building parallel with the engine room, in which case additional supervision is essential.

Every new steam plant should be carefully laid out and studied before construction; the boilers, engines, coal bins, and all details being arranged to secure the most economical results with the least labor.

The coal supply for a large mill should be secured during mild weather, when transportation rates are lowest and provisions made for storage on the premises. It always pays to house the coal, except where its cost is nominal. Bituminous coals and the softer anthracite coals lose a considerable proportion of their calorific value by exposure to the weather, and there is a decided loss with any kind of coal if it is necessary to mine it out of the pile in the winter, and bring with it a certain quantity of snow and ice, which, melting in the fire room, makes the coal wet, and the moisture must be evaporated uselessly in the furnace at the same cost as if an equal weight of water were evaporated in the boiler. There are exceptions to the rule about housing the coal. The Tide Water Oil Company uses a very small size of buckwheat anthracite, purchased in enormous quantities very cheaply in the summer, and stored in one immense pile which maintains its temperature internally so well that the coal can be taken out by cars under a crust in winter, and they have not found it necessary to house it. This plan is not recommended where a different one can be employed. Of course, provision should be made to deliver the coal direct from the cars to the interior of a storage building, and to reduce the cost of handling the coal should be taken from the storage to the fire room as required upon cars or by the use of modern conveyors which may also remove the ashes.

The type of boiler selected must be adapted to the quality of water which can be supplied to it. The ordinary horizontal tubular boilers are very efficient if properly designed, set and operated. Vertical boilers with small tubes frequently give higher evaporations, particularly with economizers placed above them, but the economy of horizontal tubular boilers can also be increased materially by the use of small, long tubes if carefully managed. Both the vertical and horizontal tubular boilers of the shell type are necessarily in comparatively small units, and with small tubes are not adapted for the use of dirty water. This difficulty is not as important where the greater part of the steam is used for heating purposes, and the water of condensation returned to the boiler.

There is some danger in connection with all cylindrical boilers of ordinary type, and an explosion becomes very serious in the midst of the other boilers of a large plant. This and other considerations have caused the introduction of a very large number of sectional boilers for all kinds of industrial work; in fact this type of boiler is in use in most of the large steam plants. Some of these boilers can be forced to double their rated capacity in case of emergency, and at the same time give ordinarily as high an evaporation as the average run of boilers of ordinary types. Moreover, as a general rule the repairs upon the better forms of sectional boiler are very much less than for ordinary boilers. Sectional boilers are, moreover, made in larger units, generate steam freely and rarely fail to give satisfaction.

The first station of the New York Steam Company was designed by the speaker to contain sixty-four sectional boilers of 250 horse-power each, a total of 16,000 horse-power. The boilers were arranged in four tiers with sixteen on each floor, facing a central fire room, there being a rectangular chimney in the centre of each row. In this way this immense power was massed on three city lots, each 25 feet in width, and about 125 feet in depth. The coal storage was above the boilers, the coal conducted to the boiler fronts by chutes on alternate columns, and the ashes conducted away to the cellar by chutes in front of the intermediate columns. The power not being at once demanded, only three stories of boilers and one for coal storage were originally constructed, and as the boilers operated most economically at 20 per cent. above rating, it has only been found necessary to put in a few additional boilers to obtain the 16,000 horse-power in winter originally desired.

On account of the high price of dock property in New York, the coal had to be brought to the building in carts. It was dumped into cars which were backed through the cellar under the front area of the rear building, and such cars were run to an elevator in the boiler house and lifted to the top, where they were run out over the coal storage and the coal dumped. Similar cars in the cellar received the ashes and were run on the elevator, carried to the top of the rear building, and delivered the ashes through a chute to a cart backed into a niche in that building. This is still the largest boiler plant in the world. To be sure, the large steamers of the Lucania class contain over 30,000 horse-power, but this is on a compound engine basis of 15 pounds per horse-power per hour, whereas the boilers of the Steam Company are rated on a 30-pound basis and run regularly at 20 per cent. above capacity. The multiple story plan has been followed in constructing some large electric stations in several cities, but it will not be necessary in ordinary steam plants. The speaker has not yet found any of the recently constructed large stations which operate with more economy than that of the Steam Company. As the coal flowed to and the ashes ran away from the firemen there was no difficulty in operating 600 horse-power of boilers (1,200 horse-power on a compound engine rating), with one man, and though the modern coal conveyors have undoubted advantages compared with the system adopted in the Steam Company's plant, the work was on such an enormous scale there that no saving is known to have been made in operation.

Automatic stokers of various kinds have been applied for a number of years. The capacity obtained per man with those of the original type proved inferior to that obtained by the Steam Company's system, so the speaker has not been impressed with the value of such devices. He is now assured, however, that they are perfected to such an extent in connection with modern means of hoisting the coal and removing the ashes that very little labor is required. A careful investigation of the more modern of these plants would be necessary to ascertain if such is the fact. There is, however, a better chance for economy in this direction in a paper mill, where the demands for steam are nearly uniform, than in an electric light station, where the demands are so extremely variable throughout the day, and a load liable to be brought on suddenly in case of a storm.

In order to secure maximum economy it is desirable that economizers be used in connection with all types of boilers. The

oretically the economy in well designed boilers depends upon the area of the heating surfaces, but not in direct proportion. With a coal consumption of 15 pounds per square foot of grate, careful experiments showed that 4.68 pounds of water were evaporated from and at 212° per pound of coal, with the heating surface only three times the grate area, or about the same as is exposed in the furnace of a marine boiler. With heating surface six times the grate 2.6 pounds additional were evaporated, or 7.28 pounds in all, and the results due to increased surface were as shown in the following table:

Heating surface to grate.	Evaporation from and at 212°.	
	Addition by Increased Surface. Pounds	Total. Pounds.
3	4.68	4.68
6	2.60	7.28
9	1.54	8.79
12	.97	9.76
15	.63	10.39
18	.51	10.90
21	.40	11.30
24	.31	11.61
27	.24	11.85
30	.18	12.03

In regular practice the evaporations are ordinarily only about eight-tenths of those given above. Evidently the surface would need to be very greatly increased to obtain any material increase of evaporation. It is not ordinarily customary to construct a boiler with more than 25 to 30 square feet of heating surface per square foot of grate, or, what is more important, to operate a boiler so that more than 0.5 to 0.6 pound of coal is burned per square foot of heating surface. The additional surface necessary to reduce the rate of combustion per square foot of heating surface is usually erected as a separate structure called an economizer. Its office is that of a feed water heater, and as the temperature of the feed water is lower than that of the water in the boiler, the surface is more efficient than boiler surface. Frequently economizers bring the temperature of the products of combustion so low that the moisture in the escaping products of combustion is condensed and causes corrosion of the tubes. It is desirable, therefore, to make them of cast iron, which corrodes less easily. The automatic system of continuous cleaning is also desirable. At the Tide Water Oil Company one of the superintendents set up a number of old horizontal tubular boilers to form an economizer, and while the speaker expressed a fear that the tubes would soon become corroded and require renewal, such has not been the case at the latest advices, for the reason that the boilers are used continuously day and night, and as this is the condition in a paper mill it appears that a somewhat cheaper construction of economizers may be adopted when all the conditions are studied.

Great care should be taken in connecting the several boilers so that the current of steam from one will not retard the flow from others. Care should also be taken to avoid pockets in which water of condensation may lodge when boilers are shut down, and cause danger from water rams when steam is turned on.

Everything about the steam machinery of a paper mill should be of a reliable character, without great complication, as many intricate details would be liable to derangement, and cause a stoppage of the plant much more damaging than minor savings in fuel for a considerable period. The engine driving the machine should particularly be of comparatively simple type, with all parts readily accessible, and with details that can be readily replaced. It is a question whether in some important mills it would not be better to duplicate the engine and driving attachments.

The keynote of saving by the use of exhaust steam is never to allow any steam to escape. Therefore care should be exercised in selecting an engine of the proper size. It should furnish the power to operate the paper machine with a reasonable degree of expansion, and without delivering more exhaust steam than is required for the dryers and other regular heating purposes. The pressure to be employed should be well considered in relation to the power required for the machine. The higher the steam pressure the more economical the engine, but the greater the losses by condensation in the various connecting pipes. The pressure must be sufficient so that all the power required will be obtained from steam used afterward for heating purposes, when, if there be deficiency of exhaust steam, the low pressure supply may be augmented with live steam direct from the boilers, and in certain cases from boilers operated at a lower pressure, and there will be no material loss, as the whole quantity of steam will be used for heating purposes and the power be obtained for a nominal cost, as it only requires about one-eighth of the heating power of the steam which passes through the engine, as previously explained.

The water of condensation from the dryers should be returned to the boilers at as nearly the full pressure supplied thereto as possible, so as to keep up the temperature of the feed water. Each 10° increased temperature of feed water corresponds to a saving of 1 per cent. of the fuel. Hot water can be pumped successfully if it be kept under pressure. It may be necessary to lower the pumps, so that there will be a slight head upon them, but this can be generally accomplished without difficulty.

Steam pumps exhausting continuously into the atmosphere should not be tolerated for any purposes. If used at all they should exhaust into the low pressure pipe leading to the dryers. So much steam is required to operate such pumps that it will be very easy to obtain more exhaust steam than is required for heating purposes and its escape will, as stated, cause a direct loss. It is therefore better generally to depend upon power pumps operated at will either by the steam engine or by water power, though it is well to have steam pumps in reserve as auxiliary feeders and for fire purposes.

The speaker is informed that in some locations difficulty has been experienced in properly draining the drying cylinders. The water of condensation necessarily tends to collect at the bottom of each cylinder and continuously flows back toward it as the cylinder revolves. Such water needs to be lifted to or above the height of the trunnion before it will flow out. The simplest method of drainage is with a stationary siphon. One branch is extended to the bottom of the cylinder; the other should be carried down outside to a lower depth and connected through a hot water return system with a closed hot well from which the water is to be withdrawn by the pumps. Unless the steam supply pipes are very large the difference of condensation in different dryers will produce a slight difference of pressure in the same, so that the siphons from some of the dryers will act while those from the others will not, at least until quite an accumulation of water takes place. A great part of the difficulty may be obviated by setting a separate trap for each dryer. The so-called steam traps which operate by difference in temperature instead of the weight of the water are not steam traps at all. They are really heat traps; that is, they hold back the heat and operate as soon as the water reaching the trap cools. Some of these which will operate with a very slight change of temperature may answer as steam traps so far as drainage is concerned, but it is not desirable that the water should be allowed to cool. The correct form of steam trap is one in which the valve is opened by the weight of the water as soon as sufficient water accumulates to fill the bucket or lift the float operating the valve. Many of these devices have been so cheapened as to be at times worthless. Even with a separate trap for each dryer the traps will stop working if there be any air in the system, unless there be a pass-by opened all the time slightly so as to keep a current of air, steam or water moving through the siphon. A pass-by, however, can easily cause a very considerable loss of steam. The rule should be made never to permit the outlet of one to be concealed, for if it be and the pass-by be left open by misjudgment or carelessness steam may escape continuously and, if it goes to the atmosphere, it will be entirely lost, and if to the hot well may interfere with the action of the pumps. Passbys should be very small and open into the room. Then, as soon as the air is blown out in starting steam will follow and it will be necessary to shut them.

For these various reasons it is recommended that the siphon system be not adopted when it can be avoided. The well-known scoop method is much preferable, as the water in flowing around as the cylinder revolves will enter each scoop as it passes, be lifted above the center and run out of the trunnions to the return pipes. Exterior siphons may be used on the connections to allow for slight differences of pressure, as is common in connecting the risers of steam heating apparatus.

It is surprising how large a quantity of steam at high pressure can pass through a small fissure opening into the atmosphere. Frequently minor leaks are neglected, whereas if there be any considerable number of them they will increase to a perceptible degree the cost of the steam power. It is essential, therefore, that repairs be carefully looked after, and that no steam leaks be permitted. The pipe coverings, moreover, should be kept in good order so as to avoid direct waste of heat by radiation.

We may be expected to say a word in relation to that great auxiliary of steam and water power, viz., electricity. It is easy to be too sanguine on the subject. This unseen force can do so many things in such an excellent manner that those who have not had extensive experience with it imagine at times that it is a cure-all for difficulties and the acme of modern progress. Let us impress upon you that for all ordinary purposes electricity is a luxury. Still we Americans like luxuries and can afford them. No gentleman who has made a fortune would consider his house perfect without electric lights; modern office buildings cannot omit them, and in some branches of manufacture electric lights are so much superior to any other method of lighting that questions of relative cost are of no importance in comparison with superior results. Moreover, ample water power may be available so that the cost will be greatly reduced. If, however, it be decided to put an electric plant in a paper mill, never buy the cheapest. The danger from fire due to improper work cannot be neglected. In every manufactory, and particularly in the moist places about paper mills, the wires should be erected only in iron or steel pipes with tight joints, and everything else should be made to correspond.

Local electric transmission has its advantages where the points at which power is to be delivered are widely separated, and it is practicable by means of high tension electric currents to transmit power, for instance, from a waterfall for long distances, utilizing at the end of the line generally more than one-half the theoretical power of the water. Where water power is cheap and abundant this is desirable, as the annual cost will only be the interest on the installation added to the cost of maintenance. Under other conditions hold fast to what you already know to be good.

The speaker has at some length gone over: first, the general principles which have an important bearing on the uses of steam in the manufacture of paper, together with illustrations calculated to excite interest in the general subject. He has then endeavored briefly to point out the care necessary in relation to certain details of operation. He would in conclusion plagiarize a well-known sentence to the effect that "eternal vigilance is the price of"—economy. In the operation of any steam plant the regular routine duties of the engineer are sufficient to keep him occupied and it is with the greatest difficulty that he is prevented from falling into a sort of routine in regard to matters which must be attended to to keep the mill in operation, so that he does not worry in relation to features which seem to be going well and therefore do not threaten a stoppage. In a large steam plant it pays to have some one to look after details who has no routine duty, but who is on duty all the time and is of a sufficiently nervous disposition to drop in and look after matters at unexpected moments. In our previous remarks, which we have endeavored to clothe in very simple language, there will be found references to a number of details which need not so much frequent attention as repeated oversight, no matter how well everything appears to be working. The economies may not be large in individual instances and yet be of great importance in the aggregate.

We may assume that any engineer with proper self-respect and not tied down too much to routine from lack of reasonable assistance will have a pride in seeing that his machinery is kept clean, that it operates noiselessly, that leakages are stopped, and in a word that everything is kept in apparent good order. He will also satisfy himself during the hours of stoppage that pistons and valves are tight and that the boilers are kept free from scale and the soot and ashes cleaned from the tubes of the boilers and economizers. All these things are of great importance; most of them are matters of observation by the proprietors and fix the character of the engineer, but there is one point which we have left to the last because it is the most important. It is to carefully look after the firing. Here the great waste in a steam plant occurs continuously. A corps of young engineers from the technical schools can come to almost any plant, post men here and there to take observations, and without the slightest interference with any of the practical details of operation report results which the proprietors by careful comparison will find, nine times out of ten, show a consumption of coal per pound of product, 15 per cent. to 25 per cent. less, during the time the experiments were in progress, than the average shown by the books for a long period of regular operation. This will occur when no part of the machinery has been changed, when the rate of production is the same as the average and the coal of like quality. The difference must then be chiefly in the way the firemen do their work. They know how to fire and will show their skill when there is a test in progress. If there were but a single boiler and it was somewhat difficult to maintain the steam pressure the fireman would have to show his skill continuously, but when there are a number of boilers and particularly when there are a number of firemen, for one excuse or another more boilers will be put on than are required for the work; the firemen will on opening the doors make the fires considerably heavier than necessary, thereby saving themselves the trouble of firing more frequently and with more care. Holes will burn in the fires of some boilers, allowing cold air to go through. Some of the firemen, and probably the best ones, will let their fires get into a condition of inactivity so that they will not require much coal, and the green firemen therefore will have to work harder to keep up the pressure. There are scores of details of this kind which there is no time to mention, but which any intelligent practical engineer already knows, or should know, and take steps to prevent.

We will only take up one more point. Frequently steam plants, not necessarily those of paper mills, have from long use become run down in some details, or they have been built up piecemeal, so that different parts designed for the same purpose do not operate co-ordinately. Pipes have been connected with a multitude of turns and fittings which ought to have been straight. A number of engines or a number of pumps are employed where one would be more economical. Boilers of different types are yoked together on the same stack with different percentages of heating surface in relation to the flue openings, so so that one set does not perform the work it should and another is overloaded. In such establishments the saying is well exemplified that "a fire would be a blessing," as it would then be necessary to reconstruct and it would possibly be done on a proper scale and in the proper way. Electric railway cars have their advantages, but it is not all due to electricity. In order to put in the new system the old tracks have had to be thrown to the winds and everything done in a better manner. It is our experience that in many manufactories a general change would be for the better, generally for the reason that work has been started on too small a basis and continued in what may be called an economical but in fact an illiberal spirit. In making improvements so much remains that is good that proprietors do not have the moral courage to build new from the foundations. It is, however, a fact that it is not always necessary. There is no infallible rule even in mechanics. People must get away from the humdrum of everyday life once in a while, see what others are doing, hear what others have to say, and then determine for themselves, as they would for another individual, what it is for their best interest to do, and to do it. Meetings of this character are in line with our suggestions, which we trust have proved of interest and may, when studied in detail, be considered of value. We thank you for your very kind attention.

Forestry and Wood Pulp Supplies.

BY PROF. B. E. FERNOW.

Gentlemen—When accepting the honorable invitation of your officers to address a group of business men at their annual meeting on the subject of forestry, I felt doubtful whether any good can come from such a general and theoretical consideration of the subject, such as alone can be given to it on such an occasion.

Is it likely that business men who have invested in their mills and plants, as the combined paper and pulp trade has to-day, probably over $200,000,000—and producing over 3,000,000 tons of material, worth over $100,000,000—is it likely that business men representing such interests need any advice of a general sort as to any portion of their business? Is it likely that they should have neglected proper consideration of the requirements of any phase of their business, at least as far as regards any general policy which they should pursue, in order to make the business profitable and the investment permanent and safe?

Yet the very invitation of your own officers for outsiders to discuss one phase of your business lends countenance to the supposition that there is felt to be a deficiency of consideration in regard to this one item at least, namely, the question of supplies of raw material, which, in my estimation, is the most important one in a manufacturing business that requires the outlay of considerable capital for plant and machinery.

As a business proposition, the discussion of forestry before you means largely a discussion of the future of wood supplies for the wood, pulp and paper trades, for forestry is nothing more or less than the rational use of forests, the art of managing and reproducing wood crops, the securing of future supplies.

Before entering upon this my main theme, you will, I hope, excuse a short digression, especially as the digression has a bearing upon the attitude which you may take to the main question.

The people of the United States, for perfectly intelligent reasons, are prone even in business enterprises to speculate rather than to employ their means in permanent investments. They will build mills, roads and other structures, and enter upon business with no expectation that their business and their structures need to last their lifetime; they are ready to abandon them when the basis for their speculation is gone, hoping that by that time the speculation will have netted not only a profit but also have reimbursed the outlay for mills and structures.

Thus a $50,000 saw mill will be established to cut out the available timber surrounding it within four, five or eight years, then to be abandoned: a mine will be equipped for operation, expensively, without any knowledge as to the likelihood that its stores will continue to yield for half a decade; and so on, the miller, the miner are ready to shift their base of operations at any time.

For such kind of business men it is useless to discuss the future, they have only an ephemeral existence in view. But gradually, as the pioneering days wear away, as the country fills up, as the rich resources have been exploited for their cream, and skim milk only is left, and as the bounty of virgin nature threatens to be used up within calculable time, the country must settle down to more conservative business; the need of considering the future forces itself upon the more thoughtful; mobility becomes less profitable, stability and permanency become a necessity, and continuity of the basis of its own existence must be taken into account in establishing or carrying on a business.

I take it that in an assemblage of men who have built costly mills, some of which have required an outlay of hundreds of thousands of dollars, there will be those who look upon their plants not as speculations, but permanent investments, who can therefore appreciate a conservative policy and who may be willing to look into the future, not only the immediate or the coming year, but the more distant in which, nevertheless, they themselves will still play a part.

And those who belong to the ephemeral sort may, after all, for a short half hour at least take an historic interest in the discussion of the future.

The wood pulp industry, as you are aware, is a development of recent times. Just a third of a century ago the first large pulp mill was established near Philadelphia, but the phenomenal growth of the industry began only within the last dozen years or so, during which the product has been doubled three times until now over one and a half million tons of pulp, two-thirds ground and one-third chemical pulp, is the annual output of the 1,200 mills, more or less, requiring not less than 2,000,000 cords of wood.

While the growth of the industry will perhaps not continue at the same rate as in the past, there seems no good reason why it should not extend further and continuously, for, in spite of the enormous increase in the use of wood pulp, there is as yet but one-third of our paper consumption supplied by this material. At any rate we may for some time to come consider the consumption of 2,000,000 cords of wood per year an exceedingly conservative figure upon which to base our considerations of the future supplies.

Where do these supplies come from? Although there are some broad leaf trees, or so called hardwoods, used for pulp, especially poplar, birch and maple, with little beech, basswood, gum and buckeye, the bulk of our wood pulp is made from coniferous wood, and especially from spruce, with pine, hemlock, cypress, fir and tamarack in smaller quantities. That is to say, the bulk of the pulp is made from that class of timber which is also most heavily drawn upon for lumber supplies in general; for of our enormous lumber consumption of nearly 40,000,000,000 feet B. M. at least two-thirds is coniferous material. Again six-sevenths of the pulp product comes from the Northern States and relies, therefore, on the coniferous soft woods—spruce, white pine and hemlock; furthermore, at present three-fourths of this product is from the Northeastern States—New England, New York and Pennsylvania.

Hence, for the present practical purposes, from the standpoint of the millowner, the supplies of this confined area would only need consideration. For it is unlikely that transportation of the bulkier raw material from any long distance to the mills will ever be practicable; the moving of the pulp mill to the bases of supplies would probably suggest itself more readily.

What are then the supplies of these soft wood conifers in the Northeastern States? In Senate Document No. 40 of the Fifty-fifth Congress I have attempted to arrive at some idea as to the condition of this resource on the basis of estimates from various sources.

In this connection, I will point out to you that it is a pitiable fact that we have as yet no reliable statistics of our forest resources, because no adequate provisions for obtaining them have ever been made. This lack is a testimony to our lack as a community of business sense, namely, that we do not know the status of the resource on which our most important productive industries—second only to agriculture—are based, industries in which over $1,000,000,000 of capital is involved, which employ over 1,000,000 workers, and whose product aggregates annually over $2,000,000,000 in final values.

With the knowledge in general that our forest resources are on the decline, would it not be wise economy to spend the two hundred or three hundred thousand dollars which it would take to ascertain precisely their condition, and thereby stimulate more careful use and recuperation? It would then be possible to speak with more assurance on the subject of the present inquiry.

Unquestionably an area of 40,000,000 acres, which is credited to the section under consideration as under forest cover, could, if properly managed, produce without difficulty and forever, annually, three or four times the amount now annually taken from it. But that only under proper management, which is at present lacking.

If there is a shortage in wheat crops or cotton crops two remedies suggest themselves at once: Economy in their use, which comes about naturally by the increase of price; an increase of the crop the next year to make up the deficiency. The governor, the regulator of supply and demand, works automatically, rapidly and instantly. The same remedies suggest themselves also for meeting a deficiency in wood crops, with the additional one of improvement in the machinery and processes of using the same. But there is one very essential difference in the two cases. The field crops mentioned are annual, the shortage needs to last only one season, is known readily and remedied readily.

Wood crops require many years to mature; the knowledge of even an approaching shortage is difficult to attain; the governor of all other trades which adjusts prices and thereby balances consumption and supplies on hand, works sluggishly in the case of wood crops, and only just before the danger point is fairly reached does it indicate overpressure.

Even now you are but little concerned, and the general public, which is finally the party more hurt by such loss or shortage of a valuable resource, sits in ignorance, awaiting its fate helplessly.

You know not and do not appreciate the situation, and probably believe me a croaker, knowing how thin my basis for conjecture, both as to present and future supplies, is. Yet I doubt whether any one of you knows the situation better or can bring proof that my conjectures are wrong. This only goes to show that our statistics of the wild growing wood crop are so deficient that they do not impart motion to the governor or balance wheel.

I suggest, therefore, that it is to your interest, as well as that of the public and its representative, the Government, to supply this defect in your machine: Secure sufficiently accurate knowledge of the condition of our varied timber resources and of their future promise. Such knowledge, I believe, will wake up our happy-go-lucky wood-working industries to a realization that their basis of supplies needs repair badly; that the glory of the times of bounty has passed, and we will for a time have to live on scant rations.

When once we know how far our virgin woods are depleted and how short the remnant, we may at least conclude that it will be wise not to squander the remainder uselessly. This will bring us to the next step, namely, to protect forest property against fire. The few feeble, half-hearted attempts at doing so in some of the States again exhibit our lack as a community of proper business sense and communal morality, for to protect life and property of its citizens is the first and primary function of communal life and government, and forest property has the same, nay greater, right to consideration in this respect, for it is property which cannot be restored except by many years of patient waiting. I would suggest that as a powerful association of men, most directly interested in this class of property, you insist upon efficient execution of this function in each State in which you are located.

Then, when the first essential for the conduct of any permanent and staple business, safety, has been secured and the influence of civilization extends into the wild woods, then we may apply the final remedy for our situation—forestry, the art of judicious management and reproduction of wood crops.

Just as the farmer sees to it that his field is fully stocked with useful plants, so the forester tries to have his land not only fully stocked, but fully stocked with the right kind of trees, useful and thrifty, keeping out or cutting out the weeds; for there are weeds as well among trees as among other vegetation. He harvests his crop when it is most useful, i. e., when it pays best considered from the standpoint of an investment, not a speculation; but at the same time, and here he differs from the mere logger, he secures a reproduction of the crop, for he proposes to stay in the business of growing wood crops, to hold on to his land as an investment.

This reproduction is by no means necessarily secured by planting, but it can be had merely by judicious cutting. The magnificent spruce forests of Germany which bear a burden of from 10,000 to 12,000 feet when 100 years old, of which 60,000 to 80,000 board feet is saw timber, with 250 to 350 trees to the acre, have mostly been secured not by the planting tool, but by natural reseeding under the guidance of nature by skillful foresters.

There is the greatest misconception in this country as to what is implied in this word "forestry," which twenty years ago was not even defined in our dictionaries. Even most of the enthusiastic friends who desire this art applied in the United States have had a curious notion of it.

Forestry is with regard to wood crops exactly what agriculture is to the production of food crops. At first the virgin soil responds without much trouble to the

scratching of its surface, but by and by the soil is worked out and it requires some knowledge to make it bear a crop again; the necessity of increased food supply and mismanaged soil capital creates the farmer; just so, when the virgin wood has been exploited, the necessity of increased wood supply creates the forester. Just as the farmer knows how to get from the soil a larger product and correspondingly larger money return for his labor, intelligence and knowledge, so the forester knows how to get—by entirely different means to be sure—a larger and better product and larger money return from his woodland.

Would you know how it pays to manage a wood crop instead of roughly exploiting it as you do? Take, as an example, the government forest administration of little Saxony, with a round 400,000 acres, mostly poor mountain land, and almost entirely spruce. There has just been published a most interesting record of the results of this administration during the last eighty years (1817-1895)—results of a systematic, rational management.

We will go back only forty years in order to make the comparison fairer, for industrial life, stimulated by railroad development, does not reach back much further. We find that while the net results of the administration during the decade 1854 to 1863 were only $925,000 annually in the average, or, with the then somewhat smaller acreage, over $2.50 per acre, in the decade 1884 to 1893 they were $1,900,000, more than double—or nearly a clear million dollars more—the net revenue being $4.50 per acre. Mind you, this is only revenue or interest taken while the property itself is not depreciated but improved, for we find at the same time that the growing stock of wood on the area had increased over 15 per cent. per acre, and the acreage in old material over sixty years had also increased 2 per cent.; several thousand acres of waste land had been planted, while also permanent roads and other improvements had been made and the property brought into better condition generally; so that figuring the revenue as representing only 3 per cent. on the investment, the value of the property had risen in those forty years from $30,000,000 to $63,000,000, or more than double. That is to say, the property has not only paid 3 per cent. annually in revenue, but added 2¼ per cent. annually to its value; and all this while the property is still in a period of improvement. Do you know of any large business in which all speculative values and contingencies are excluded that can do better?

Perhaps you are inclined to think that prices of wood may account for this great prosperity. To allow you to judge, I will state that forty years ago the price averaged 7¼ cents per cubic foot. This means wood cut to logs and billets ready at the roadsides for hauling, all over 3-inch diameter. At the end of the period it was 9 2-3 cents per cubic foot, i. e., an appreciation of 33 per cent. in forty years. This is difficult to translate into American measures, but it is certainly not very much higher than the cost for similarly situated areas in this country. How little, by the way, the price of wood has influenced the money results will appear from the statement that while the price for wood increased during the forty years by 33 per cent., the gross income from the property increased 234 per cent. and the net revenue over 80 per cent.

If we consider the results from the wood supply point of view, we get at an idea of what the forester still can do in securing a greater yield.

In 1854 there were on the area 860,000,000 cubic feet of stock, old and young wood, or 2,300 cubic feet per acre, which by 1894 had increased through conservative management to 1,100,000,000, or 2,675 cubic feet per acre. This is the wood capital accumulated, of which only the interest is used. Yet during that period there had been removed, exclusive of brushwood, not less than 1,000,000,000 cubic feet of wood, or on the average annually 25,000,000 cubic feet.

At present the annual cut is nearly double what it was fifty years ago, namely, a round 29,000,000 cubic feet, which is less than the annual growth, since the proportion of old timber is still allowed to increase, in order to bring the property into ideally normal condition. It is also interesting to note that while forty years ago more than half the cut was firewood, at present less than one-quarter comes to this inferior use, which is partly due to changes in economic conditions and uses, to be sure, but in part also to the skill of the forester.

Not to weary you too much with statistics, I may only add that last year the now 430,000 acres, more or less, with an administration that costs a round $445,000 and expends annually $180,000 additional for improvements, and after paying $450,000 to woodchoppers and laborers in harvesting the crop, etc., or a total outlay of nearly $1,000,000, net the Government (while wood in the forest, cut, brings 10 cents in the average per cubic foot) a round $2,000,000, or say $4.65, with 70 cubic feet cut, for every acre—good, bad, indifferent, young growth and old; and 60 cents net for every cubic foot of wood, while the stock of standing timber is increasing.

That is forestry in the spruce forests of little Saxony!

This, to be sure, is in a specially favorably situated section, in a state not larger than Connecticut, amidst thriving industries, with a population of over 3,000,000 people. Yet even in less favorable conditions with larger areas management pays. Thus Bavaria, equal in area to Maine, with a population equal to that of New York, with its very mountainous territory, owning in her state forests somewhat over 2,000,000 acres of forest land, which cannot for various reasons be as intensively managed as that of Saxony, more than half of it in spruce and much on poor soil, with an average cut of 60 cubic feet per acre, increased the net revenue per acre in these forty years by over 70 per cent., the net income being $1.95 per acre, and that when the average price for wood is less than 70 cents per cord in the forest, cut, and 66 per cent. of the total wood cut is cordwood; when $185,000 is paid out for roads and their maintenance, and $145,000 for planting, and, altogether, the cost of the administration amounts to $3,880,000 or $1.80 per acre.

I hear some of you exclaim that this is all right for European conditions, but that such things cannot be done here, or in any country less densely settled and developed than Europe. It will astonish you to hear that the Dutch in Java, far away from the wood markets of the world, think that they can afford to pay from $4 to $14 per acre alone for planting teak trees, which is done by farmers who, in addition to the price of planting, have the use of the ground two or three years for agricultural crops.

Then there is India, where, under still less favorable conditions a most successful administration has been developed by the English. The first attempts at some rational forest management in India date back to 1865, when it became apparent that the rough exploitation would soon lead to exhaustion, but even to-day when more than 65,000,000 acres are reserved or under Government control, the administration of this vast property is only partially in working order, and hardly yet 12 per cent. is being systematically managed, while 30,000 square miles are under organized protection against fire. Yet in the face of constantly increased expenditure for fire protection, road building, amelioration and administration, as the reserved area increased, the revenue in twenty-five years, from 1869 to 1894, increased to just five times its original amount, being in the latter year over $4,000,000, while the expenditures have increased nearly three times, being for permanent cost of administration $4,500,000 and nearly $400,000 for surveys, boundary demarcation and other extraordinary expenses; and that while fuel was given free to many adjoiners, over 80,000 acres were planted.

The inspector-general of this vast forest administration says that the progress in organization alone accounts for the regularly increasing receipts. The product was 190,000,000 cubic feet of timber and fuel, about one-quarter timber, besides 150,000,000 bamboos and nearly 2,000,000 minor produce, there being large amounts of tan materials, caoutchouc and lac gathered. Sandal wood, ebony, padouk and other ornamental woods and teak, the only structural timber of value, form the main products.

Again I hear you say: "Well, that is the English Government that can do so." Listen to the words of the inspector-general of India. Speaking of the forest administration of native states, he says: "Progress continues satisfactory * * * from Mysore with its fully equipped department down to the smallest states of the Himalayas, where a few years ago it could scarcely have been anticipated that a native chief would to-day, acting on the advice of an occasionally inspecting forest officer, be able to point to his oak forest, being regularly worked as coppice, with standards with the dense young growth of six successive years, thoroughly protected from cattle and topping, and proudly talk of the revenue of $7,000 to $8,500, representing $1.50 to $2 per acre per annum on the area of his forest."

This is the force of example upon the poor Hindoo!

Now look at your own forest areas! What do you get from them and what do you or can you expect from them after the virgin growth has been removed? What knowledge do you apply to manage this part of your most valuable property? What is its future? Who of you even knows what area you should have under management to supply your mill continuously?

You are cutting simply the accumulations of nature without any reference to what the future brings. You are cutting them to the smallest size that you think it will pay you to move out of the woods. Sometimes an uncertain feeling, that perhaps it pays better to leave the smaller trees, largely old runts, and come for them at a later time when they are bigger, prompts you to leave more, but I doubt whether any one of you has ever seriously considered that merely by properly regulating your cuttings you could, without curtailing your final harvest, reproduce a young crop and keep your property in ever-improving, revenue-paying condition, by employing a regular trained forest manager. Management of forest property there is none!

Look at the manner in which our woods have been and are even now exploited! First comes the lumberman, who only sees white pine; he makes his roads, builds his shanties and mills. When he has cut out the best and his roads are grown up to wood and washed out, his shanties broken down, there comes another who only wants tulip, poplar, or walnut, or oak, or some other one kind, and he builds new roads, new shanties and so on, each one going to the expense of rigging up anew, each one creating a waste left in the woods which might have answered some purpose other than his own. It is only lately that a division between the lumberman and pulp man is made here and there, the pulp man taking the inferior material and cutting the better logs to lumber. More such management at least is needed.

Just as the mining industry only thirty years ago was carried on in an empiric way without scientific basis or direction, while now well educated assayers and superintendents are employed everywhere, so the time will come when every owner of the forest property will have learned that there is such a thing as forestry, which requires technical training, and which can increase the product and property of the forest area far beyond the unaided efforts of nature left to itself.

There is one point more I wish to bring out which is suggested by the published remarks of one of your members, which were as follows:

"* * * At no distant date, when the increased cost of wood to foreign mills reaches a point which it is certain to do soon owing to the pronounced stand being taken in those countries against the indiscriminate cutting of wood (on account of its relation to the water supply and power of their rivers) we shall be able to cultivate a foreign trade in American pulp and fibre which shall be both permanent and profitable."

This is, indeed, mistaking the situation, and in the light of the above statements from Saxony is evidently an unfounded conjecture. While in this country people may well be alarmed by the enormous growth of the wood pulp industry, which is slashing the forests even more closely, and hence wastefully, as far as considerations of the future are concerned, than the lumber industry; in Germany the foresters welcome this industry with delight, for they now can sell to better advantage the inferior parts of the trees which formerly were good only for firewood, and still more advantageously they can dispose of the material that comes from the thinnings of the young growth, which from silvacultural reasons were highly desirable but had often to be omitted because there was no sale for the material. It is the offal largely which is given over to the pulp mill, the better parts being used for better purposes. Besides, Government control of private forestry has become less stringent, not more so.

No, gentlemen, whatever other factors may help you to find a foreign market, there is no hope to increase your exports on the supposition that the forest owners of Germany will spoil their well-established, profitable business of wood growing. The only hope is in managing the first end of your business, that upon which the whole existence of your mills is based, better than hitherto, and utilizing the forces of nature and the greater fertility of your soil and climate to outdo the German forester; in other words, by applying forestry.

SUPPLIES OF PULP WOOD IN WISCONSIN, MINNESOTA AND MICHIGAN.

The lumberman and the wood pulp manufacturer will have to divide the supply of the spruce, pine and hemlock material, while balsam, fir, tamarack and poplar remain mainly for the use of the latter.

There are no absolute statistics in existence, but we can arrive at a general idea of the possible supplies on hand by various calculations and by the use of such data as are in existence.

For Michigan the Commissioner of Labor reports, in 1897, 2,250,000 acres of standing pine and hemlock. For the Upper Peninsula we are justified in increasing this area by figuring as follows: Of the area of 12,0000,000 acres, fully 10 per cent. is swamp and probably 40 per cent. is cutover land, leaving about 50 per cent., or 6,000,000 acres in woods, from which, however, the white pine is mostly removed. For the Lower Peninsula such calculation is not practicable, and we have to rely upon the reports of the Commissioner of Labor, adding another million acres; assuming on this acreage an average crop of 3,000 feet per acre for pine and hemlock we would have 20,000,000 M. feet. To this we may add for pulp wood, including tamarack, spruce, balsam and inferior pines and hemlock, 12,000,000 cords. For poplar we have no data, but the Southern Peninsula must contain large quantities.

For Minnesota we have the Chief Fire Warden's estimate by counties, which credits 20,000,000 M. feet B. M. of pines, spruce and tamarack to the State. If we take the wooded area at about 13,000,000 acres, take off for swamp and open area or cutover lands 4,000,000, we have 9,000,000 acres well wooded, which would mean for that State 4,000 feet per acre, or a round 36,000,000,000 feet of white pine besides 10,000,000 cords of small material.

Hemlock is entirely wanting, and of spruce we may not count on more than 2,000,000,000 feet, or 4,000,000 cords, twice what the Fire Warden's estimate, above referred to, gives. Two million cords of balsam fir and 13,000,000 cords of tamarack will add greatly to pulp wood supplies.

For Wisconsin we can speak with more confidence and certainty, for a very competent agent of the Forestry Division has just canvassed the State thoroughly by personal inspection and otherwise.

He reports that poplar occurs only in small quantities, not worth considering. Spruce occurs scattered chiefly in swamps and the humid eastern parts. Not only does it occur scattered so that no large logging operations are practicable, but it is small, generally under 12 inches in diameter and under 60 feet in height; 800,000 cords might be culled altogether. Balsam fir also is never large and never abundant, although widely distributed; not more than 700,000 cords may be counted on. Hemlock seems to be on hand in greater quantities than is usually believed, growing on all clay and loam areas of the eastern humid portions, prevailing in many places though wanting over large tracts. It may be estimated at 7,500,000,000 feet, with 10,000,000 cords of small material. Tamarack may furnish 1,250,000,000, fit for piles and piling, besides 3,000,000 cords of pulp wood. Finally, white pine shows by a close canvass 16,500,000,000 feet standing, to which at least 5,000,000 cords of small material may be added for pulp purposes.

Putting these figures together we have an aggregate of a round 80,000,000,000 feet of saw timber in which lumber men and pulp men have an equal interest, and, in addition, a round 60,000,000 cords of pulp wood alone.

The cut of lumber last year was 6,250,000,000 feet, pointing to the capacity of that business to use up the supplies in little more than twelve years, while the pulp mill capacity reaches as yet hardly 450,000,000 pounds, or a requirement of a round 300,000 cords, which if the mills used only the cord wood reported, would show an inexhaustible supply, provided no increase in capacity, no fires and no competition for the supply from other consumers occurred.

How to Apply Forestry to Spruce Lands.

BY AUSTIN CARY, M. A.

Gentlemen—The subject assigned to me is forestry in actual application to the spruce lands of New England.

The wild lands with which I have more or less personal acquaintance are those of Maine and northern New Hampshire. Of these, the westerly ones are as a rule the more valuable, partly because they are nearer to market, no doubt, but mainly because they possess in the run a heavier stand of timber. The mountainous region of northern New Hampshire, at the head of the Connecticut, the Merrimac, and the Androscoggin, is the core of the natural spruce land of New England. Mr. J. A. Pike, of Berlin, N. H., before his death the best posted man on a large portion of this territory, set its average stand of spruce in the natural condition at 10,000 feet. East of that, across the Moosehead region, in Maine, and to the New Brunswick line, the average stand of timber grows lighter. A hundred millions of spruce per township is considered a large yield in the region of Moosehead—about 5,000 feet per acre. Eastward, on the Penobscot and St. John, when men are asked about the average natural stand of timber they are more apt to mention 3,000 feet than any other figure. This shrinkage in the stated stand from west to east is due partly to differences in methods of measuring and estimating timber and to varying degrees of closeless with which land is cut. Much of it, however, is to be attributed to actual difference in the timber stand. Spruce to the west runs both larger and thicker than it does to the east. Merchantable spruce timber, too, stands on a larger percentage of the land.

One consideration will go far to explain this relation in timber stand. It is altitude above sea level. The stand of timber increases from east to west; so does height of land above sea. The higher land on the line between Maine and New Brunswick is about 500 feet above sea; Moosehead Lake is 1,023 feet; the upper lakes of the Rangeley system lie at 1,400 to 1,500, while the average elevation of the mountain district of New Hampshire is still higher. That is to say, forestally speaking, spruce in New England is a tree of the high altitude, and the rough climate which naturally goes with it. The lower lying lands, including southern New Hampshire and southwestern Maine, have little of it.

Within the region of its distribution,[1] spruce stands in a great variety of ways. Comparatively seldom does it stand in pure groves. Fir, for one thing, though generally of very inferior size, is almost universally associated with it. Then the hard woods native to the region almost always make some degree of mixture. On the better lands, the easy and better soiled ridges particularly, the mixture is apt to be strong, even going so far as to amount to replacement. In these mixed lands, however, are found the very largest and finest of our spruce. Of the hard woods native with us yellow birch[2] is most extensively found, commonly accompanied by beech and maple.[3] On poorer sites, however, these latter go out; and sometimes on exposed mountain slopes, particularly where timber is short and open, the former gives way to its hardier relative, the white birch.[4]

These three species—spruce, white birch and fir—are against cold and exposure the stayers. Together, they mount as far as there is any soil toward the highest summits of New England.

Again, there are stands which, though seldom pure, are mainly and characteristically spruce. These occur most frequently on steep mountain sides, and on very rocky and poor soiled flats. Sometimes the timber is thick and heavy—it is often a surprise to see how little soil suffices to produce a magnificent stand of spruce; sometimes, due to extreme exposure or to bad drainage, the timber is small. Thick spruce and fir growths, in which the trees never reach a larger size than 12 or 14 inches on the stump, yet valuable for the large amount of wood per acre which they possess, are a not infrequent feature of our best timber lands.

The variety in species and form, moreover, is accompanied by diversity in age. Throughout all varieties of stand in which spruce occurs almost always are trees of every age and size mixed together.

Each single acre of forest land, therefore, has its peculiarities. On each is exhibited a multiplicity of facts and relations, all of which are of importance; all of which, if we are to make the most of our forests, we shall have to learn to take into account. Soil, its composition and drainage, determines the rate of growth of trees. It affects their health also, and limits the size which on any piece of ground they can attain. Thus on a piece of good land in our forests a spruce tree cannot be considered fully grown unless it will scale 400 to 500 feet, while on other ground trees 12 inches or even less in stump diameter, may be the best that you can ever expect to gain. The lay of the land is another matter of manifold concern. To us it is of particular concern from the fact that our spruce, with its shoal rootage, is especially liable to windthrow, from which the shape of the land may largely protect it. Undergrowth again may be of great importance. For instance, in some portions of our New England spruce woods the dwarf maples[5] and hobblebush[6], which are the usual undergrowth, seem so abundant and so favored by the soil that after a cut they cover the ground stripped with such density as to exclude other species. Such facts as that vary greatly with locality. They escape commonly undetected, yet they strongly affect, from the point of view of steady spruce production, the adaptability of different tracts of land.

Each acre of forest land, too, contains trees of different species, and some of these on the lands we are considering are utterly without value. Further than that, situated as they often are in competition with the spruce which you do desire, they are a detriment and a drawback to the land. Take the big scraggy yellow birches for instance, the most common feature of this nature in our heavy spruce lands, where they are generally of utterly worthless character. They overshadow small growth, they break off the tops of young trees that get up into their limbs, making them forked or stubbed. They furnish seed to supply spruce with its evenest competitor. With these facts perhaps you are already familiar. If so, you must have thought of a remedy. Forestry applied to these lands certainly will kill off these birches, and a thing which it seems to me any of you could do, with very little expense, to increase the growing power of your lands is to girdle a lot of them.

[1] Picea nigra.
[2] Betula lutea, sometimes with lenta.
[3] Species according to location.
[4] B. papyracea.
[5] A. Pennsylvanicum and spicatum.
[6] Viburnum lantanoides.

ILLUSTRATION.

In a New Hampshire forest note of the following facts was taken: A large forked yellow birch had the crowns of three pulp-size spruces locked in its branches; while a larger tree, 15 inches in diameter, had pushed its way through. Underneath, or near by, stood four spruces between 6 and 10 inches in diameter, and two smaller ones. All these would have been greatly helped by the death of the birch.

Then as to the spruce themselves, the condition of different trees and the relations which subsist between them. Trees, dead of old age, stand on most acres of virgin land, and with them go others past their prime, shrinking in quality every year. Such trees, if they are to serve any useful purpose, should, as soon as possible, be cut. Next comes a proportion of poor trees, such as are diseased, deformed, or that through dense and greater prolonged shading have lost their vitality. These may be of any size. Having, as a rule, some value to cut, they are not such trees as we should most desire to let grow. Then there are the big trees oppressing the little ones. The big trees are heavily crowned trees, big for that very reason. As one tree overtops its neighbors and gains access to increased light and air its foliage thickens up, its limbs lengthen, it crowds and covers over the young growing stock in its vicinity. Thus a big tree may overshadow a whole patch of little ones a foot or a few feet high. A half-sized tree may be wedged in between others, long and slender in shaft, and with thin crowns. Such a tree, if you suddenly relieve it of all support from its neighbors, is particularly apt to blow down. Here may be a grown tree overhanging half a dozen struggling ones a good deal smaller. If we were cutting here but conservatively, with a view to growth, we should take that big tree out, and you see that if carefully done we should leave ample stock to replace it. Not always, however, is the stock of young growth thus amply sufficient. Sometimes, for instance, a big spruce stands isolated in a piece of hard woodland. Such a tree so situated is an outpost in the lines of the enemy. Keep that fellow for seed supply. Perhaps if you look closely you will already see signs of his work. His retention is the main hope for the future of spruce for rods around.

Gentlemen, I didn't plan to speak of cutting so early in this address, but in describing the features of forest land, as nature gives it into our possession, I have been led to it almost of necessity. A strange idea it may be to you, but the virgin forests of New England, from the point of view of permanent spruce production, really need to have cutting done upon them. Cutting is needed to save wood from decay. It is also needed to put the land in better growing order. If we could go together for a short trip in those forests, you would see at once, and clearly, how it is possible to do here what, as has been shown you, has elsewhere actually been done—improve the natural condition of land and increase the rate of its growth of timber.

All of these ideas will be rendered clearer by record of the trees on a sample half acre notes of which, collected in the woods, in the employ of members of this association, are appended. After a score of the trees and comment on their condition is noted the treatment in the way of cutting, which we may say really needs to be done to put the land into best growing order. The half acre is a heavily timbered one from northern New Hampshire. It possesses some 8,000 feet of spruce, large and small, and the notes show that about 3,000 feet could be taken from the land in the shape of trees that are over-ripe, or else are impeding the growth of young timber. If these could be taken away, and in addition, due deference being paid to wind protection, about a dozen worthless birches could be killed, the land would really be in much better growing condition.

The question next arises: To what extent does lumbering, as now practiced, carry out the purpose of forestry in preserving and promoting the growing power of the land?

Most of you are doubtless best acquainted with pretty systematic and thorough methods of lumbering. You perhaps have bought timber land on an estimate of the spruce timber standing upon it, and you have gone in and taken the spruce that you paid for. That has been the sum of it. You have employed sharp, energetic men, and told them to cut the land clear. Perhaps you have had virgin timber running 10,000 feet to the acre, and of it, if fairly systematic, you may have left 1,000. That is very loose work in comparison with some I have seen, where it appeared that of the total amount of spruce wood, big and little, naturally standing on the land, operation had left alive but 1 per cent. But to take into account only the ordinary degree of thoroughness, you have, to sum it up, taken all the grown timber from the land, all the half-grown, and, though they may have paid you no stumpage over the cost of handling, many of the ungrown striplings as well. That, of course, is what up to this time you have meant to do, but our business to-day is to study the operation from the point of view of future growth. What can you count on for the future? How long before you can go onto that land again for another crop? How much small timber is there left, and what shape is it in to grow? What kind of new growth has cutting started into existence on the land? To answer these questions notes of another sample area will help us. It is a half-acre, cut over ten years ago, in the heavy spruce lands of New Hampshire.

The first inference I will draw in relation to these facts is that land like that here described is in shape to grow effectively of spruce wood in board measure per acre

somewhere about 50 feet per year. That, gentlemen, understood as representative, and taken in connection with the area of our spruce-bearing lands, is a very significant figure. However, I am not to apply it in that way. We will rather turn our attention to the condition of the trees of which the stand remaining is made up; see how they are fitted to go on and attain that growth which we now realize to be an object. See what we get from this representative area.

HALF ACRE OF HEAVY SPRUCE TIMBER IN NORTHERN NEW HAMPSHIRE.

SPRUCE.

No.	Diameter Breast High. Inches.	Total Height. Feet.	Condition.	Treatment Recommended.
1	14.5	60	A fair tree.	Cut. Frees Nos. 2 and 3.
2	10.5	40	Partly free.	
3	8 5	50	Partly free.	Kill the birches.
4	9.5	45	Between two birches.	Kill the birches.
5	7	30	Under birches.	
6	8	35	Under larger trees.	Cut. Frees 6, 7, 9 and 10.
7	7	35	Under larger trees.	
8	20	75	Grown tree; over others.	Kill the birch.
9	8	40	Thin crown; crowded	
10	10	50	Top in a birch.	Killing a birch will help.
11	13.5	60	Partly free; growing.	Kill the birch.
12	10	50	Partly free; growing.	Kill the birch. Cut this.
13	14.5	55	Top in a birch.	Kill the birches.
14	17	60	Top in same birch	
15	7	35	Under birches.	
16	21	80	Heavy crowned, but impedes none.	Cut it. Frees 19 and several smaller.
17	16.5	70	Thriving finely	
18	25	90	Old, seamy tree.	
19	7	35	Thin crowned, under	
20	17	70	Good, growing tree.	
21	8	30	Under 20 and 22.	
22	16.5	75	Fairly thrifty tree	
23	6.5	30	Thin; under others.	
24	9	30	Stubbed.	
25	9	50	Fairly thrifty	
26	8.5	45	Less thrifty	
27	14	65	Open, thriving tree.	Cut. This helps 5 small trees.
28	20	80	Heavy crowned, grown tree	
29	6.5	30	Under others; thin.	
30	6.5	30	Under others; thin.	
31	10	50	Fairly thrifty tree.	
32	16	70	Thrifty tree.	
33	10	40	Free and fast growing	
34	11	45	Stubbed by a birch.	
35	14	50	Stubbed by a birch.	
36	7	35	Under a large spruce	Cutting will free.
37	6	40	Very th n crowned	
38	11	55	Fairly thrifty	
39	7	25	Under a birch.	Kill the birch.
40	20	70	Grown tree; over others.	Cut. Will free several.
41	8	40	Between 40 and 42.	
42	20	80	Little impediment to others.	
43	14	40	Stubbed by a birch.	Cut. Helps several smaller.
44	9.5	55	Fairly thrifty.	
45	11	55	Fairly thrifty.	
46	9	45	Top in a big birch.	Kill the birch.
47	10	45	Top in same birch.	Kill the birch.
48	9	45	Fairly thrifty	Cutting others will help this.
49	10	50	Fairly thrifty	Cutting others will help this.
50	14	60	Thrifty tree.	May be cut to free 4 smaller.
51	14	65	Thriving tree.	
52	13	70	Oppressed	
53	9 5	50	One-sided crown.	
54	14	70	Thrifty tree	
55	12	55	Thin crowned	
56	13	70	Thriving tree	
57	14	60	Fairly thrifty; impedes 3 smaller.	
58	15	70	Thrifty tree; over others.	
59	13	60	Thrifty tree	
60	28	75	Fully grown	Cut. Helps many small.
61	10	50	Crown compressed	
62	8	50	Crown compressed	
63	8.5	50	Crown compressed	
64	12	65	Good, thrifty tree	
65	12	65	Good, thrifty tree.	
66	14	65	Good tree, thrifty; impedes 4 smaller	
67	12	65	Thrifty tree.	
68	9.5	55	Fair tree.	
69	7	30	Thin crowned.	
70	11	45	Thin; under next.	
71	22	75	Grown; impedes 3 smaller.	Cut.
72	6	30	Thin crowned; shaded.	
73	6.5	40	Thin crowned; shaded.	
74	7	30	Under a birch	Kill the birch.
75	7	30	Under same birch.	Kill the birch.
76	10	50	Under a birch.	Kill the birch.
77	11	45	Fairly good tree.	
78	8	35	Top in a birch.	Kill the birch.
79	7	35	Under a birch.	
80	19	80	Grown tree; impedes several.	Cut it.

Summary of Spruce.

Saw-log trees over 12 inches on the stump, 26; about 7,000 feet B. M.
Pulp spruce (smaller, down to 6 inches breast diameter), 44; about 1,000 feet B. M.
Should be cut to aid growth, 10; about 3,000 feet B. M.
In addition there are on the area, between 3 and 6 inches breast diameter, 16 trees.
Smaller spruce (50 being in one bunch), 200 trees.

OTHER SPECIES.

Of *fir* there were on the ground 3 trees larger than 6 inches breast diameter, 11 between 3 and 6 inches, and several hundred smaller.
Of *maple*, 3 trees stood on the area and a bunch of small ones.
Birch, mainly white birch and entirely worthless, as follows:

Diameter.	Relations.
28 inches	.....Impedes 4 small spruce.
16 "	.....Shields 3 spruce of pulp size.
12 "	.....Impedes 3 little spruce.
12 "	.....Shields but one spruce.
17 "	.....Stubs 2 spruces, shields 2 others, also shades 2 patches of little spruce 1 foot or so high.
15 "	.....Impedes 2 spruce.
18 "	.....Impedes 5 spruce.
18 "	.....Impedes 1 spruce.

Of eighteen trees, more than 6 inches in diameter, standing upon this half acre, five are thin-crowned trees, oppressed in the original stand, which, so severely changed in their conditions, have not yet shape to grow. Plainly, it is the poorest of the natural stand that you have left—left it for that very reason. It is not in good shape to grow, and it can produce, as a matter of fact, very little. It will perhaps be fifty years before you will care to come back over that land. At 100 years the crop could hardly fail to be inferior to the original.

ILLUSTRATION.

HALF ACRE HEAVILY TIMBERED LAND IN NORTHERN NEW HAMPSHIRE CUT THROUGH TEN YEARS AGO.

Possessed, besides trees scored, a good many small firs, 10 large birches, with several smaller ones; also a few maple and beech. Has also 12 spruce between 3 and 6 inches diameter, and about 100 smaller spruce, being better than most land about in these items.

SPRUCE STANDING.

Breast Diameter. Inches.	Total Height. Feet.	Condition.
10	60	Stands open.
8.5	50	Thin crowned.
8	35	Under a big birch.
8	35	Stubbed by hard woods.
5	70	Poor tree.
1	50	Thrifty tree.
7	50	Under a big birch.
11	50	Stubbed by hard woods.
11	40	Under a birch.
10.5	40	Top in limbs of same birch.
10	50	Poor crown.
7	75	Poor, crooked tree.
7.5	35	Crown thin.
9	60	Fairly good tree
10	50	Good tree.
10	50	Top in a birch.
7	50	Rapidly growing.
7	50	Under a big birch.

Total, 18 trees; about ½ M.
Of these there are of vigorous trees left in good shape to grow, 5; damaged or impeded by hard woods, 8; deformed trees and trees crowded in the original stand, and therefore in poor shape to grow, 5.

The second is a piece of ground which some twenty years before was cut too open. The spruce left were growing very fast—an inch in diameter every five years would hold for many of them. But they were so open, and their crowns were so long and heavy, that the greater part of the timber never could make desirable lumber. As to spruce reproduction, too, there is something to learn. There was on one end of the piece a bank of young spruce and fir a few feet high, covering an area of several square rods. Elsewhere, however, fir was much more numerous than spruce, while very much of the regrowth was deciduous.

The third area is most interesting and instructive. It was picked to show, as nearly as might be in natural forest, the ideal condition. It represents this the better because there is only a small mixture of anything else but spruce. Many years ago three pines were cut on the tract. At a later date men came and took thirteen spruce, these having been pretty well distributed. Across the half acre they cut one road. The result, viewed now at the end of twenty-three years, is singularly fortunate. Most of the small trees were set free and they are finely growing, though seldom one with a too long or bushy crown. The road mentioned, where the ground was left openest, had filled in with white birch and cherry, but elsewhere throughout there were little spruce in moderate but sufficient amount. It seems possible that this half acre has now more lumber standing on it than it had in the natural condition. If not, it certainly bids fair, if left a few more years, to acquire it.

On the basis of this example we can clearly and definitely illustrate the difference between forestry and lumbering. This half acre is just such ground as one of your lumbermen cutting pulp wood would delight to swoop down upon. He would get, perhaps, 6,000 feet off it, and he might leave it in shape to grow, say, twenty-five board feet per year. That would have to accumulate fifty to seventy-five years before you would care to come after it.

The forester, on the other hand, would use this piece of land much differently. There is, indeed, about a thousand feet of lumber on it which he would like to cut, in the shape of a few old trees, and also of imperfect ones, which are impeding their neighbors. He might even cut some of the larger of the other trees to make up a respectable operation. This would be under protest, however, for the trees, 12 to 16 inches in breast diameter on this tract, are just the ones which are producing most, right in the very height of their power of wood production. If the forester could have his way entirely, leave everything standing except the 1,000 feet I have mentioned, the half acre, as near as I can judge, would in the next fifteen years grow more than 2,000 feet of lumber. That, taken out carefully, in the shape of the largest trees, the rate of growth stated—150 feet approximately in board measure per year—the half acre should be able to permanently maintain.

ILLUSTRATION.

YEARLY GROWTH OF SPRUCE ON CUT-OVER SPRUCE LANDS OF KENNEBEC RIVER, IN MAINE. FROM 240 OBSERVATIONS.

Breast Diameter of Tree. Inches.	Yearly Growth. Cubic Feet.
7	.26
8	.33
9	.39
10	.45
1	.51
12	.56
13	.62
14	.68

THREE SAMPLE AREAS REPRESENTING LAND (1) TOO DENSELY COVERED TO GROW WELL; (2) TOO OPEN TO DO BEST; (3) JUST ABOUT RIGHT. MOOSEHEAD REGION.

AREA NO. 1.

Quarter acre of mixed growth, from which 8 spruce were cut 20 years ago, not enough nor well

ILLUSTRATION.

HALF ACRE BURNT OVER 108 YEARS AGO.

SPRUCE.

Breast Diameter—Inches.	Number of Trees.
14	2
12–14	8
10–12	18
8–10	46
6– 8	36
3– 6	36
	146

OTHER SPECIES.

Breast Diameter. Inches.	Number of Trees.		
	Pine.	Poplar.	White Birch.
24	2	..	..
16–18	6	..	..
14–16	2	6	2
12–14	8	6	..
10–12	4	2	2
8–10	8	..	6
6– 8	..	..	8
3– 6	..	..	4
	30	14	22

General height of spruce, 60 feet. Other trees, much higher as a rule, impede the spruce but little.
Spruce, 146 trees, 1,740 cubic feet; probably about 4 M on close cut and scale.
Other species, 66 trees, 3 840 cubic feet.

around. Often their battle is prolonged through many decades. Sometimes spruce no more than 3 or 4 feet high represents as much as 50 years of struggle. At 100 years of age, the average spruce in our forests is perhaps but 6 inches in diameter, containing only about 4 cubic feet of wood. And yet they retain vitality. The history of grown trees proves it. Study by the rings of the trees cut in our forests shows us that the bulk of our timber has come to us in that way.

Examine after this the vicinity of the sample half acre presented. It was in mixed, but heavily timbered, land, where bunches of heavy spruce alternated with areas covered largely with hard wood. The bunches of spruce were cut clean, what was not used being smashed down, so that large gaps were made in the cover of the land. The scattering spruce outside could not be cut so thoroughly, and those left, with the hard woods, still formed a thin cover. Now note the difference in new growth. The gaps after ten years were densely filled with a variety of deciduous growth. Part of it was of sprout origin, come on from the original undergrowth, which, cut off or bruised in the lumber operation, and thrown open to the full light of the sun, had shot out new heads more numerous than those of the fabled hydra. Wherever these had left a gap, cherry, with birches and maple, had filled in; so that ten years after the cut, on land which showed by the stumps that it had once possessed the very cream of the timber, one could go for rods through and under a dense growth of these forest weeds and see on the passage hardly an evergreen tree. It was on other portions of the land, in the parts that originally had less spruce, where there was most spruce reproduction. Just think of these facts, gentlemen. They are worthy of attentive consideration. On those portions of the land where in the original stand there was most spruce, there you have left least, and the least capacity for production.

The example here used is a somewhat extreme one. It is adduced to illustrate a principle. Mixed land is seldom so favorable to forest weeds as it is here, while on natural spruce land the case of spruce reproduction is as a rule vastly better. Oftentimes in the woods the reproduction of spruce seems free and abounding. It would be hard to check it. But the principle I believe to be true, and if so it is certainly of great importance. Spruce germinates and gains its early growth readily under a shade. Big gaps made in the cover are apt to fill up with its competitors.

Thus you see, gentlemen, that from consideration of still another factor in the life of the forest we arrive at the same conclusion previously gained as to the usual method of treating the land. Condemnation of hard cutting is indeed the keynote of this address. For its bearing in every direction on the productiveness of the forest, we must condemn it. By hard cutting I mean any cutting which takes systematically two-thirds or three-quarters of the timber standing on the land. We must include in it such cutting as would aim at leaving of the normal stand of spruce in New Hampshire and Maine only the trees 12 inches or less on the stump. There are circumstances in which the bad effects of hard cutting are mitigated; there are regions where without an entire reversal of policy the very hardest cutting is the only practicable policy to pursue. In general, however, it is incompatible with the generous production of our spruce forests. Hard cutting not only takes the mature timber from the land; it takes away or destroys most of the young growth, on which depends all prospect of reaping another crop within the next fifty years. In general, it helps to throw the ground permanently over to the possession of other species. No wonder, gentlemen, that further thing is true with which you are all familiar, that it wipes out the market value of your land.

On the other hand, there are facts and conditions to be observed in our forests today that teach us much as to the lines of better management, and define our ideas as to what its results will be. The best field for the study of these phenomena is in those regions where lumbering has been carried on longest. The extensive use of spruce for paper making in Maine began within twenty years. It is only within the last fifty years, indeed, that spruce for any purpose has, in large amounts, and on the larger rivers of the State, been cut. Previous to that, however, there was for many years an extensive output of pine. The distance to which pine was pursued before men began to turn spruce to account is truly remarkable. Fifty, a hundred, even two hundred miles the lumbermen of half a century ago went off to the wilderness, hauling supplies on ox sleds, living in camp all winter, and coming down with the drive in the spring. So far from market, with the price they got, they took and they could take only the largest and soundest trees in the forest, and the clearest parts of them. But the main point for our present purpose is that as the pine in the backwoods was seldom thick or pure, generally a good deal scattered, in fact, standing in groups and singly in stands made up mainly of other species, the cutting, though reckless enough, was light, and opened up the cover only in little spots and patches. Now pine, in contrast with spruce, is a light needer, and in the little gaps and openings which the early cutting made it was not generally the pine which came on again, but where spruce was on the ground, and conditions were favorable, it was spruce instead. The upgrowth of spruce largely occurred, no doubt, through the oncome of spruce undergrowth already present, but much of it also was due to new seeding. At any rate, by one means or another, much of the territory once cut for pine now has a great amount of thrifty young spruce, which if not yet of marketable size, has great promise for the future.

ILLUSTRATION.

SPACE 25 x 50 FEET (ABOUT 1-30 ACRE) FROM OR CLOSE TO WHICH THREE LARGE PINES WERE CUT FIFTY YEARS AGO. NATURAL SPRUCE AND PINE LAND. MOOSEHEAD REGION.

Breast Diameter. Inches.	Number of Trees.	
	Spruce.	Fir.
14	1	..
12	2	..
11	1	..
9	0	1
8	3	2
7	2	..
6	5	..
5	4	1
4	6	..
3	15	..
Under 3	13	..

Total, 54 trees, about 175 cubic feet. General height, 40 feet. Cover so dense that there is no undergrowth. Several little spruces are dead.

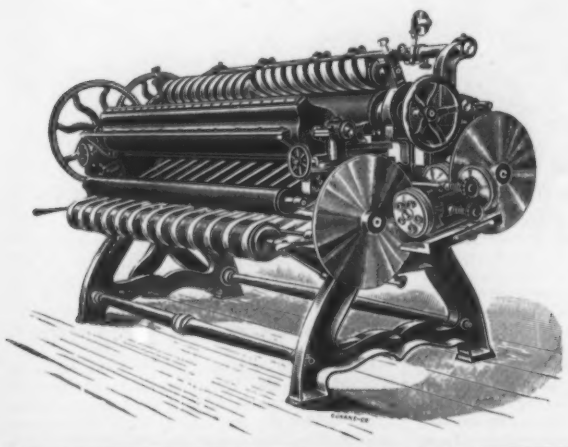
Then men began to saw spruce and market it, and so they went back over the land again, striking for the thickest and biggest of the timber, taking at first such trees perhaps as would scale three or four to the thousand, and leaving everything smaller, with the regions of thin timber, to stand. Later on the cutting was to a lower standard, and in some regions once lightly treated finally became severe. Elsewhere, however, nothing but good-sized saw logs have been cut, and there are great areas in Maine where those tactics are pursued to-day. For fifty years or more some of those townships have been cut on in a moderate, unsystematic kind of way. One man has cut till he got the best chances logged. Then the same after a few years, or some other man, perhaps in his old works, has gone on and cut more. Half a century these tracts have been cut on, they have yielded beyond all expectation, and yet they are not exhausted. In fact, there never has been a time when they have been worth so much to sell in the market as they are to-day.

I have no praise to bestow on the system of holding and management under which lands described have been operated. There are wastes and losses in it such as I hope those who are yet unfamiliar with them may never know. But I say that the history of those tracts, in the way they have yielded, in the advance of their valuation, in their actual timber condition as it may be seen to-day, contains a lesson for us as we study how to make the most of our remaining forests, that we might not from more distant examples so forcibly learn. The point is that the treatment of those lands was light, discursive and gradual. When men cut a big pine, with the road by which they got it out they made a mere scratch on the surface of the forest. There was no violent change in the conditions of trees about. No hole was made for the wind to get in. Trees standing about simply used the light and space to the quickening of their own growth, while young spruce seedlings, saved from the overbearing of forest weeds to which in a larger opening they would have been subject, took underneath possession of the ground. Again, when men came on for the biggest spruce, they did a very similar thing. They took a few trees here, and a few there—left the timber which was either thin or small. On a well-timbered acre they might take but a dozen or twenty trees. Here, again, young growth was opened gradually, and not with violence. The ground was kept right for new seeding, and there was no chance for wind. They did, in fact, in a rough way, just what for our sample half acre we pointed out should be done to put it in growing order. The small spruce gained crown and grew up, little ones came on to take their place, and finally when the lumberman comes onto the land with his sweeping methods, as he has often of late years done, he finds sometimes such a stock of vigorous growing spruce of all sizes, from smallish saw logs down, that he couldn't obliterate spruce from the land if he tried.

Illustration of most of these statements is found in the sample areas of cut-over land, notes on which are here given. The areas selected are from the Moosehead region, in Maine, on land which has been operated as I have just outlined. The first piece of land never had enough cut on it to thoroughly open it up for growth. Big spruce are holding back little ones, but the latter are especially oppressed and impeded by hard woods standing over them. If five good-sized spruce could be cut off that quarter acre, and in addition the worst of the impeding hard woods could be killed, the yearly growth of wood on that tract, as soon as the young trees have gathered themselves, would probably be half as much again as it is to-day. The density with which the ground was shaded was somewhat unusual. Only across one end, in the side light from a road, was there any undergrowth. The shade was too dense for young trees to come on.

ILLUSTRATION.

In a New Hampshire forest 6 spruce trees between 6 and 12 inches in diameter overshadowed by hardwoods were growing on the average an inch in diameter in 20 years. Six fairly well conditioned trees on the same ground averaged an inch in 8 years. Ohio is not an extreme example.



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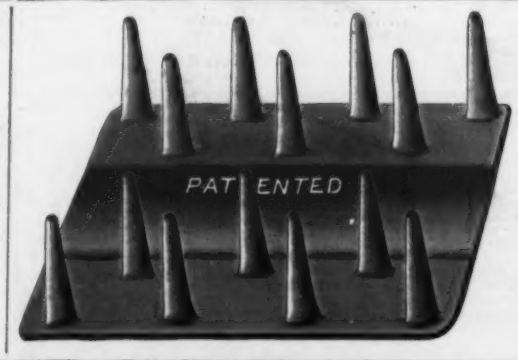

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PULP GRINDERS ARE SUBJECT TO THAT LAW OF EVOLUTION,

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THIS cut illustrates The New England Grinder as first made and put on the market in the spring of 1888, fitted to use stone 48 inches diameter, 26 inches thick, to grind wood 24 inches long, having two pockets, one on each side of the stone, placed as low under the stone as practicable, and designed to use from 100 to 125 horse power. This arrangement of the pockets causes the stone to be partially lifted off its bearings when the feed pressure is applied, thereby reducing the loss of power by friction about 8 horse, whereas pockets placed on top of the stone in the usual way increase the friction from 4 to 6 horse power each, as shown by actual tests. Of these machines about 200 were sold, most of which are in use to-day, and have never been excelled in quantity or quality of pulp made, in proportion to the power used. The same machine was also made to use stone 18 inches thick, to grind wood 16 inches long. A third pocket placed on top of the stone was afterward added, so that the machine could be used as a regular three-pocket machine, all parts being made heavier and stronger and adapted to use 250 horse power, thus increasing the capacity of the machine; the hydraulic cylinders being at the same time made larger. Next, an adaptation of pipes and valves was added, so arranged that the three pockets might be used independently, as is usually done on a three-pocket machine; or, by closing a valve, the lower horizontal pockets could be used as a two-pocket machine and the top pocket used as a regulator of speed, the valves and pipes being so constructed that whenever the feed pressure was thrown off from either horizontal pocket the same pressure was turned into the cylinder of the top pocket, thus bringing the top pocket into action during the time the horizontal pocket was backed off to be filled, and when the pressure was again turned on to the horizontal pocket it was cut off from the top pocket; the arrangement being such that when the feed pressure was transferred from one pocket to another the second pocket was always brought into action before the first pocket was released, thus insuring that two pockets should always be at work, a feature possessed by no other pulp grinder. The machine has been modified and improved from time to time, during the past nine years, fourteen times, developing in 1896 into a machine as shown in the cut below, retaining all the desirable features and remedying every known defect.

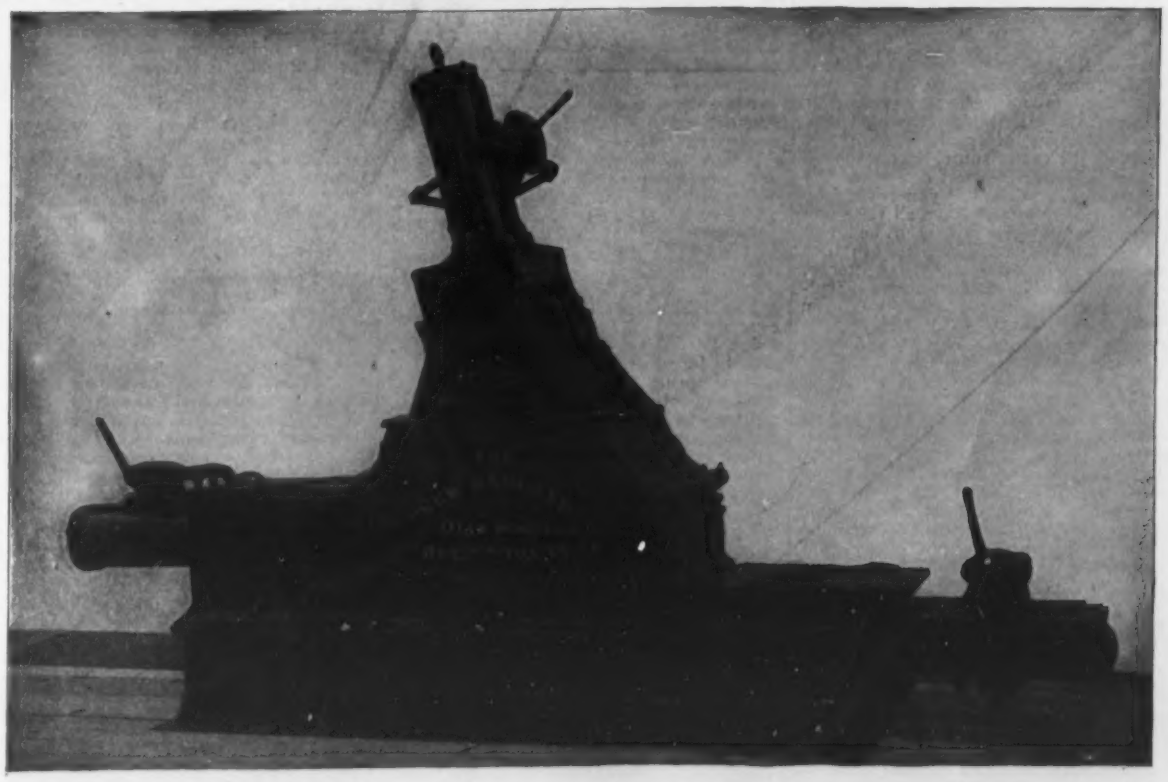
The machine represented below is now offered on the market, greatly strengthened in all the working parts, to take stone 54 inches diameter, to grind 24-inch wood, weighs 9 tons and embodies the following points: The pockets can be conveniently adjusted and kept within 1-100 of an inch of the stone, SO THAT NO SLIVERS CAN BE MADE. The follower is always moved with the cylinder and works up close to the stone at all times, but cannot touch it. Has brass-lined hydraulic cylinders, brass valves and stuffing boxes, steel piston rods, hammered shafts from 6½ inches to 8½ inches diameter, according to power used, can wear stone down to 40 inches diameter, and can take in wood 13 inches diameter without splitting. Can operate without throwing a drop of water or pulp out of the machine.

Can furnish machines, two-pocket or three-pocket, to grind wood 16 inches, 20 inches, 24 inches, or 28 inches long, at prices ranging from $400.00 to $700.00, using hydraulic cylinders ranging from 8-inch to 16-inch diameter, according to power used.

They are simplest, most conveniently accessible in all parts, most easily and cheaply operated, of any grinder on the market.

The pockets being larger than on any other machine, can use more power and make a greater product.

About 500 of these machines have been built, which are used in about 100 mills, a number greater than that of any other grinder in the world.



As figures are confusing, I make the following offers in plain English:

Will sell a heavy two-pocket grinder for **$550.00,** guaranteed to make **more pulp of good quality with greater economy** of **power and at less cost** for operating expenses than can be done by any other machine on the market.

Will sell three-pocket machine with the above guaranty, adding a stipulation to make a greater aggregate production, using any power from 100 horse up to the maximum which a pulp grindstone can safely stand.

Will furnish grinders to be run in a competitive test of from 15 to 30 days, with any other grinder on the market, under the above warranty.

Will furnish complete outfit of pulp machinery, all of the best, including grinders, screens, wet machines, hydraulic pump, stuff and water pumps, wood-preparing machinery, log haul, shafting and pulleys, all guaranteed to make 10 tons of air-dry pulp in 24 hours, of spruce wood suitable for good news paper, at a cost not exceeding $2.00 per ton, for $5,000.00, or will furnish outfits for larger mills at prices in proportion.

No Pay Required Until You Get All You Bargain For.

Write for further information. No charge for reliable estimates.

Can make designs, furnish plans and specifications for mills to be located anywhere in the United States or Foreign Countries.

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enough distributed to free the young growth. Small spruce also much impeded by hardwoods.

SPRUCE.

Breast Diameter. Inches.	Total Height. Feet.	Condition.
11	70	Fair tree.
11	65	Fair tree.
18	70	Fair tree.
17	75	Impedes last, next 2 and 2 small ones.
11.5	65	
9	50	
18	70	Impedes last and next.
9	40	Under cover; crooked.
7	35	Thin crown; under cover.
7	35	
20	75	Heavy crowned; over last.
6.5	30	Under 2 birches; thin crowned.
8	50	Fine tree, but birch overhangs it.
7	45	2 birches over will stop it.
7	40	
7	35	
6	35	
8	50	
6	30	Under a birch.
6.5	40	Good tree, but shaded and crown thin.
10.5	50	Fine tree; standing open.
10	55	Birch crowds on 1 side.
10	50	Crowded by next.
18.5	80	Heavy crown; impedes 3 smaller.
11.5	65	Dead.
18	75	Impedes next and 2 smaller ones.
12	60	Crowded between this and next
14	65	Thrifty tree.
10	60	
6	35	Under shade; thin crowned.
9	40	Stubbed by a birch.
7	45	Partly free; fairly thrifty.

Total, 32 trees, about 2 M, of which, to put the land in good growing order, at least 5, about 1 M, should be cut. There were also 32 spruce between 3 and 6 inches in diameter, 40 small ones in an open place at one end; also about 20 others, very thin and weak, scattered over the land.

FIR.

Three trees, averaging 77 inches diameter by 45 feet high; 58 between 3 and 6 inches in diameter, and 70 smaller.

PINE.

One tree 14.5 inches diameter and 75 feet high.

BEECH.

Trees 11, 8 and 9 inches in breast diameter.

YELLOW BIRCH.

Breast Diameter. Inches.	Relations.
13	Helps shade small spruce.
12	Impedes 5 small spruce.
16	Impedes 3 small spruce.
12	Impedes 2 small spruce.
12	Little or no damage.
15.5	Overhangs 8 small spruce.
14	Does little damage.
16.5	*Poor*; will die soon.
14	Impedes 5 spruce 7—11 in. diameter.
13	Overhangs several small spruce.
14	Impedes 6 small spruce.
15	Overhangs 5 small spruce.
20	Overhangs several small spruce.
18	Does little harm.

Total, 14 trees, generally crooked and worthless. Also 5 birches between 7 and 9 inches in diameter, and 8 smaller.

AREA No. 2.

Quarter acre of mixed growth which, cutting twenty years ago and winds following, have left much too open.

SPRUCE.

Breast Diameter. Inches.	Total Height. Feet.	Condition.
12	65	A birch crowds.
7.5	30	Stubbed by a birch.
7.5	30	Stubbed by a birch.
6.5	30	Under birches
9	35	Free, full crown.
13.5	65	Free, full crown.
16	60	Open, long heavy crown.
13	65	Thrifty good tree.
13	60	Fairly thrifty and open.
6	30	Poor tree.
12.5	50	Bushy crown.
10	45	Very heavy crown.
12	55	
11	50	Spreading crown.
9	50	Crown in a birch.
11	50	Short, bushy tree.
14	80	Forked, open full crown.
17	60	Forked high, heavy crown.
13	60	Open, heavy crown.
8	45	Compressed crown.
11.5	55	Stubbed by a birch.
13.5	65	Good tree.
9.5	50	Good tree.
15	65	Heavy crowned tree.
6.5	40	
8.5	45	Fine growing tree.
8	40	Fair tree.

Total, 27 trees, about 1¼ M, generally free and thriving; 8 of the larger have bushy crowns, with limbs too low on the trunk to make good lumber. Also 29 spruce, between 3 and 6 inches in diameter, and many smaller

FIR.

Four trees, between 7 and 9.5 inches diameter, in very unhealthy condition; also 10 trees between 3 and 6 inches in diameter, and many smaller. Fir, with some spruce, form in the openings several dense banks of young growth.

BEECH.

Five trees, between 6 and 11 inches in diameter, 3 between 3 and 6 inches, and 2 smaller. Generally very poor.

WHITE BIRCH.

One tree, 6 inches in diameter. Many small ones, with some yellow birch, dwarf maples and cherry in the larger openings and gaps.

YELLOW BIRCH.

Breast Diameter. Inches.	Relations.
19	Worthless.
13	Crooked.
13	Stubs a spruce.
10	Hangs over 2 small spruce.
11	
24	Damages 1 and overhangs 2 smaller.
22	Impedes 2 spruce and overhangs 3 smaller.
15	Impedes several spruce.

Also 9 trees between 6 and 10 inches diameter, 11 between 3 and 6 inches, and numerous smaller.

AREA No. 3.

½ Half acre, covered mainly with spruce, from which 40 years ago or more 3 pine were cut, and again, some 28 years ago, 13 spruce. A yarding road cut across the tract, and another along one side filled mainly with white birch and cherry. Most trees in excellent growing condition.

SPRUCE.

Breast Diameter. Inches.	Total Height. Feet.	Condition.
12	55	Open, heavy crown.
7.5	30	Under next.
11.5	60	Heavy crowned.
7.5	50	Compressed by last.
8.5	50	In good chance; thriving.
9.5	50	Between last and next; little crowded.
11.5	50	Beside road; thick crown.
10.5	55	Open and growing finely.
7	40	Somewhat crowded by last.
9	30	A poor tree. Cut, if worth it.
9.5	50	Good tree; compressed by next.
11	65	Fine, thriving tree.
8.5	50	Crowded by last.
6.5	40	Borne under by 3 preceding.
12.5	60	Good tree. } 3 3—6 inch trees
11.5	60	Good tree. } under this
9.5	50	Good tree. } bunch.
6.5	40	Good tree. }
6.5	45	Good tree.
9	45	Good tree; somewhat crowded.
7	45	One-sided crown; fair tree.
16.5	60	Crooked and poor; impedes several small trees. Cut it
12.5	50	Stubbed; shades numerous small trees. Cut it.
9.5	50	Open, thrifty tree.
13.5	70	Fine tree.
14	70	Fine tree; over 2 smaller ones.
13	65	Imperfect tree; over several small. Cut it.
7	30	Crowded by last 2.
13.5	65	Free; finely growing.
6.5	40	Under last and next.
10	55	Partly free; thrifty.
12	65	Open; nicely growing.
14	65	Open; nicely growing.
6.5	45	Between and under last 2.
15	60	An old tree; open, but unthrifty. Cut it.
7.5	45	
15	70	Old tree; also imperfect. Cut it.
9.5	50	Thriving.
14	70	Extremely thrifty.
15.5	75	Extremely thrifty; compresses next.
12	65	Thriving fairly.
10	60	Compressed by last.
9	60	Compressed by others.
14	70	Thriving well.
15	75	Imperfect; impedes 1 smaller. Cut it.
8.5	35	Free.
7	35	Free.
9.5	40	Free.
13	70	Fine, thrifty tree.
11	60	Fine, thrifty tree.
8	45	Compressed by next.
11	60	Thriving.
9.5	45	Free
8	35	Free
7	35	Partly free.
8	35	Worthless tree.
13.5	70	Fine tree; overhangs little ones.
15	75	Fine tree; overhangs little ones.
11.5	65	Good, thrifty tree.
10.5	60	Between last and next.
12	65	Fairly thrifty and good.
14.5	65	Free and thrifty.
14	70	Free and thrifty.
11	70	Thriving.
15.5	70	Very heavy crown.
14.5	80	A fine tree.
8	50	Under last.
8	40	Thin crown; under cover.
10	55	Fairly good tree.
7	40	Crowded; thin crown.
11	60	Good tree.
6.5	50	Crowded by last and next.
8.5	55	Fair tree.
15.5	70	Thriving finely.
7.5	45	Free and thrifty.
7.5	45	Crowded 1 side badly.
7.5	50	Crowded 1 side badly.
23	80	Old and grown tree, impeding smaller stock. Cut it.
12.5	65	Good tree.
9	55	Crown compressed.
14.5	70	Thrifty.
8.5	60	Compressed strongly.
7.5	50	Thin crown; under cover.
10	60	Good, thrifty tree.
6.5	35	Under; thin.
6	40	Under; thin.
8.5	45	Imperfect; thin crowned.
8.5	45	Under a birch.
6.5	30	Under a birch.
8	40	Crowded between birch and spruce.
13.5	70	Thrifty.
15	65	Thrifty.
13.5	65	Thrifty.
14.5	70	Thrifty.
13	65	Thrifty.
13	70	Thrifty.
10	60	Thrifty.
9.5	50	Thrifty.

Total, 98 trees, about 6 M. Cutting 8 trees, about 1 M feet, would improve the growing condition of the land. Also 56 spruce between 3 and 6 inches, 47 smaller than that size, yet over 6 feet high, and many more yet smaller in bunches and singly through the tract.

FIR.

Breast Diameter. Inches.	Total Height. Feet.
12	70
10	65
10	65

And 24 trees 3 to 6 inches diameter, 51 below that size but more than 6 feet high, and many smaller.

PINE.

Two trees 12 inches in diameter and 70 feet high; both thriving.

YELLOW BIRCH.

Breast Diameter. Inches.	Condition.
15.5	Compresses a spruce and shades several.
13	Does little or no harm.
13	Over several spruce.
14	Over several small spruce.

Also 3 trees 8 and 9 inches in diameter, 22 between 3 and 6 inches, and 64 smaller, these last, in contrast to the young white birch, being scattered through the tract.

WHITE BIRCH.

One tree 6 inches diameter, 5 between 3 and 6 inches, and in the road cut many small ones. Several large dead trees standing.

BEECH.

Two very small trees.

Scientific forestry, what is it, and what has it done, you have had opportunity to gather. Certain principles of it, however, it may be well to rehearse and apply definitely to our situation.

First, then, having to do with the raising of trees, forestry of necessity is a slow process. To strip the timber off a piece of ground to be sure does not take long; but that is not forestry. To cut the land in such a manner as to get the growth out of the yet undersized trees and also to utilize the trees standing to renew the stock will take a considerable time. The forester would like to have fifty years for it. He would take the old stock off no faster than it could be replaced. The great advantage and reward would be that at the end of the time you would still have a forest as at the beginning, with value and producing power unimpaired or even increased.

Secondly, forestry is a business which requires a large capital in proportion to product. In order to produce wood, wood has to stand on the land to grow. A little tree may add yearly a large percentage to its volume, yet it grows actually but a trifling amount. On the other hand a spruce 16 or 18 inches through in our forests, just reaching its maximum of wood production, may grow, in proportion to its volume, a very small per cent. Similarly on a larger scale that is so with land. If you keep it hard cut not only is the stock of wood small, but the growth as well. It is only when your land has many and good-sized trees on it, material that represents a stumpage value, that it can grow a large amount.

Thus it comes about that forestry is not a business that gains quick money returns, or returns that constitute a large percentage on investment. This again may seem to run counter to experience. Land purchases are sometimes made from which men get back their money and interest within a very few years, and have the land still with whatever may be left on it. Again, however, that is not forestry; for unless the purchase price of the land was figured much below the actual stumpage value of the timber upon it that could only have been done by the crippling, for the time at least, of its growing power. Forestry, by which I mean now keeping the land in full bearing, would require that only interest be taken, that the principal of the investment be retained, in the shape of wood, on the land. Neither would interest be at a high rate; 2 and 3 per cent. on investment is considered to be the return from scientific forestry in Europe. The relation of stock and yield under management practicable in our own woods might, as near as I can judge, be as follows: By keeping a stock of wood on the land representing to you a stumpage value of never less than 5,000 feet, an annual yield of 200 feet per acre might be derived.

So we come to the situation of the man who buys land to put it under such management as will secure to him a steady yield, who wants it, for instance, to grow wood to perpetually stock his mill. The best results in the long run are to be gained only by very light, discursive cutting. We should go on and take only the over-ripe trees and those that are impeding others of more value. We should do this, not by means of a fixed standard of size imposed on ignorant choppers to carry out, but after intelligent consideration of the facts and circumstances of each bit of land. This would promote growth. This would promote reproduction. This is the way to keep the yearly output of the forest at its topmost notch. That is what these New England States would do if they owned the land, as they once did, and if they were alive to their best interests. To be sure it would mean a big invested capital and small net income. But net income with them would be a secondary consideration. Their main ones would be the preservation of vast wealth to the State, and the value of steady and assured supply to the business of citizens.

Now, private men cannot be expected to sacrifice present gain altogether to future good. Something of the ideal must be slackened to meet their circumstances. Among individuals and corporations, however, there is a difference, and there is none whose interest lies so close to that of the forest as that of paper mill men. The forest in your whole plant is but a minor factor. Your main investment is elsewhere, and stumpage from timber is not your only source of profit. What should the forest pay but 2 or 4 per cent., if by that means its actual production is multiplied? Steady and cheap supply of wood is your main consideration here, with assurance of it for the future. Profit on manufacturing is your chief source of income.

But to return to the special field of this address. You have noticed, perhaps, that I have said nothing about tree planting so far. Perhaps you have noticed it with surprise. Introduction of this subject gives me opportunity to do a service for a valued co-worker and friend. Mr. Geo. T. Crawford, of Boston, a man whose experience and temperament have put him in sympathy with every genuine movement for the better utilization of our forests, whose judgment and counsel, too, we may hope will yet be utilized in the establishment of thorough-going, systematic forestry in our timber lands, is a man whose name in this connection is already widely known. The exact form, however, in which his celebrity generally crops out is more or less of a cross to him, for nine times of ten that his name occurs in the journals of the paper trade it is coupled with the statement that Crawford is taking a trip up into the spruce lands of New Hampshire, gathering spruce cones with which to replant extensive areas of cut-over lands for his employers. Among those who know Mr. Crawford, and who appreciate the circumstances of the case, this reputation of his is considered a pretty good joke, because Mr. Crawford gathering spruce seed and expecting therewith to restock with spruce the devastated lands of New Hampshire would hardly be more ridiculous than the physical spectacle of our long-geared and elderly friend climbing a big spruce in the immediate execution of his purpose. No, gentlemen, Mr. Crawford has no idea of figuring in any such Dame Partington-like proceeding. He knows, in fact, a trick worth a good many of that. The natural reproductive powers of the trees themselves, supplemented by such handling as will forward and not hinder it, are what he relies on to keep the land in stock. Where the case is really so bad as to have come to wholesale planting, there I think he would be ready to give it up. Here we are brought to realize our limitation in one direction, and, on the other hand, to understand what in our circumstances is the immediate and most important end at which we should strike.

In regard to the lands already hard cut, there is nothing for us to do but wait. Planting, when needed, would be more costly than could be afforded, and cutting with a view to improvement cannot, on the more distant and harder cut lands, at any rate, be undertaken, because there is nothing on them with which we can pay ourselves for our work. In respect to this matter, we shall have to lie in the bed which we have already made.

It is in the yet uncut timber where our opportunity lies—in its fullest and wisest utilization. There it stands, the gift of nature to the American people. It stands there not merely as a product, but with capacities—not as dead lumber, but as living trees. Much of it has been given to you to own and to utilize. How will you do it? Will you strip the land of its timber regardless of any other consideration? That will, indeed, be utilization from one point of view, and most of you I know can be trusted to do that with diligence and economy. But will that be the wisest thing? Have you not in so doing thrown away things that constitute a large part of the utility of this resource? Growth you have cut off—growth that might have changed the ungrown stripling into a magnificent tree. Reproduction you have put at a great disadvantage. These powers, these capabilities, part and parcel as they are of the utility of the natural forest, we can only enjoy the fruit of through slow, conservative, careful work.

Just what can we accomplish? What shall be our organization? Just how shall we begin? These important questions must, in this paper, be treated in a very summary way. Certain simple reforms in our woods work would seem to be the first thing to attend to, correcting for one thing needless destruction by our woodsmen, and teaching them in the forcible ways required to do it to understand the importance and value of young growth. Then there are our methods of getting out timber. Maine and New Hampshire operators, for instance, seldom make more than one log out of a tree; to get that to the yard they use a pair of horses. Much small stuff, of course, has to be cut to let the team through, and more has to come down before so long a log can swing. Now when logs are going to the pulp mill there is no necessity for them to be kept full length. Mr. Crawford, indeed, tells me that in New York spruce trees are sawed into short logs at the stump and yarded with one horse, as a matter of simple economy in handling. What is done there for that reason should certainly be practicable elsewhere as a means of saving the forest.

But the main question of organization awaits us. Suppose the reform is carried, and conservative work with a view to growth is determined upon; who shall yet examine the land face to face, acre by acre, and say, all things considered, what shall be cut and what shall stand? Mr. Crawford suggests that men might go through timber to be cut in summer, two or three men, under the charge of one of experience and judgment, marking the trees which shall be cut by the crews later on.

On this head, and as throwing side light on many of the minor problems which in the handling of our forests for growth we shall have early to tackle, let me recount a conversation between myself and a certain Maine lumberman as we tramped together over parts of a fine Androscoggin town. My companion had charge of seventy-five men, who were engaged in cutting the land as cleanly as is ordinarily done. He felt sorry, however, that his business was to do that, because he had a sort of feeling that he was impoverishing the country. We were thinking how the matter could be actually bettered, and looking over the timber we came to from that point of view. Here on the cut land was a spot where the little timber left had blown down. There a fire had run from the railway off through the cuttings and killed the timber on some 300 acres in a body. On that land, at least, we were glad that the timber had been cut clean.

Then we came to the virgin land, where crews were then at work. First was a stand of spruce, but little mixed, that would run 15,000 per acre. The choppers were just running into it with their roads. By this time that land is one almost unbroken brush heap. But could we do any better than that? Could we particularly cut that land lightly so as to let the stock of small and half-sized trees come to full maturity? Both of us recognized it as a difficult job. In getting out the big timber from that thick stand much small stuff would of necessity be cut or smashed down. Then if we could have cut out the larger stuff only, say a half or two-thirds of the whole of it, we were perfectly sure that a large proportion of what was left would blow down. Plainly there were only two courses open. Either very light cutting should be done, cutting to take out, at most not more than a quarter or a third of the timber, or else the whole stand should be swept off clean.

Near by was another case. Up on a mountain above us, so steep and rocky in its natural condition that it seemed as if no four-footed animal less sophisticated than a bear or a moose could travel it, dynamite and Yankee ingenuity were yet making a way for teams. What different could be done there than to cut what there was? The expense of getting there seemed to dictate that when once men and teams were on the ground, the lumber standing should be cut clean.

On the other hand, we came later to a thrifty stand of mixed hardwood and spruce. The mixture protected it from blow-downs; so did the hills which warded off the strong winds from the north. There was a fair amount of young spruce, and it was of a character that if opened up would vigorously grow. These points the woodsman understood quite as well as any one need, and if in his orders from headquarters he had been given liberty to spare young timber up to 14 or 16 inches on the stump, where he thought it could safely be done, he could have been trusted to do it to good effect. And then that lumberman made what seems to me, for the purposes of our new work and organization, a very fruitful suggestion. Put, he said, the responsibility for woods work onto two men instead of one. Supplies for your crew in the way of food and tools, also the work of the hauling teams and that at the rail, if such is a part of the operation, put under the charge of one man. Leave the other man free to supervise the cutting. Put on him the work of marking the trees that shall be cut. He shall oversee the transportation of the timber from the stump to the main roads. His task will be, trained to it himself, to fight down the old wasteful habits of the men. Here will come the brunt of the operation. This work will require a clear-headed, active and a resolute man. But these characteristics are not wanting in the men who now have charge of our woods work. Many are the men taking charge in our woods to-day at $30 to $50 per month, of better natural ability—more energetic, clearer headed, with better judgment—than the average of men in the so-called learned professions. Many of the points of the work involved are already understood by them. Those men set to work on the new lines will do it effectively. They will do it gladly too, as a measure which they know means much to their own prosperity and that of the country.

But do not omit from your system the professional forester, the trained, educated man. Do not omit him, and do not put him too far away from the actual work in the woods. To organize the work we have outlined, and carry it on at its proper level, will require a man both of broad views and of broad training. Scientific knowledge from many directions he should be able to bring to bear on the problems in hand. Of forestry itself the established principles are best learned abroad. As to minor arrangements, too, those of our European predecessors are likely most helpfully to suggest. Then there is the broad policy of the woods work to define in accordance with the natural conditions, in relation to other branches of the business, with a view to the welfare of the whole plant. Can you not, on the valuable and productive spruce lands of which I have mainly been speaking, afford one such man for each 100,000 acres? Perhaps it may sometime appear that you could not well have afforded anything less.

There are, indeed, no men ready at present to take that responsibility, but men can be put in training as soon as there comes a demand. Take from among the young men every year turned out from our colleges a sufficient number, of active disposition and scientific, yet practical, taste. Turn them out into our woods work to assure yourself of their adaptability, and until they know from top to bottom the conditions with which they will have to deal. Give them next two years of study in Germany or France, just as the British did for their forest service in India, until they could properly train men at home. Then bring them back. Give them both freedom and responsibility. Give them liberty also to study and experiment. Above all, be not impatient, but grant them time and the conditions, without which real forestry is not possible, and you will see, I believe, built up here in the spruce woods of New England a system of forestry working to your benefit, of which too America will have no reason to be ashamed.

The Sustained Yield of Spruce Lands.

BY GIFFORD PINCHOT.

[The following brief summary of results obtained in the course of a study of the Adirondack spruce is in the nature of an extract from a small volume to be published hereafter, and which has not as yet been fully prepared. This will explain the hasty nature of these notes and the fact that it has not been possible at the time of going to press to present the results as fully and as systematically as would have been desired. When completed this volume may be obtained by application to the secretary of the association.]

INTRODUCTORY.

The study whose results are here in part presented had its origin in a conversation between Dr. W. Seward Webb and the writer in November, 1896. The arrangement then made contemplated a division of responsibility between Dr. Webb and myself, according to which his contribution should consist of the funds necessary for the pay of assistants and the necessary field expenses, while my share involved the planning and supervision of the work, and the preparation of its results for publication. The whole undertaking was to be managed with reference to the "preservation and proper management of spruce lands in the northeastern United States as its primary object."

It was evident at that time, and it is still more evident now, that the original forest cannot long suffice to supply the increasing demands for spruce which are made upon it. To provide for a second and for succeeding crops of spruce is the obvious and necessary way to prevent a scarcity of this valuable tree and the consequent crippling of the industries which depend upon it. The purpose of the present study was to acquire such a knowledge of the laws which govern the growth of this tree that the main facts necessary for the conservative treatment of spruce forest may be put within the reach of the men most likely to undertake it.

There are two qualities which enable the spruce to maintain itself in fairly uniform proportion in the Adirondack forest. These are its ability to live under the heavy crowns of other trees, called tolerance of shade, and its remarkable power of reproduction. The latter depends first of all on the great quantities of seed which are produced year by year. The seeds of the spruce are winged, and as they ripen and fall from the cones the winds catch and spread them widely throughout the forest.

In this way the chance to take possession of suitable localities can be used whenever it arises. What these localities are is clearly indicated by the prevalence or absence of young growth. Thus it appears that spruce seedings germinate and grow easily on deep spruce or pine duff and on heavy beds of moss. Leaf mould seems less thoroughly adapted to their requirements, but they are found scattered in greater or less numbers almost throughout the forest. In small openings, especially those made by windfalls, they are most frequent, and here they occur in dense groups, growing rapidly under the influence of the light. In other still smaller openings in the forest such groups, of greater or less extent, are very common, and form one of the distinguishing features of the reproduction of this tree. In larger openings, caused by fire, the return of the spruce to land from which it has been burned away is often slow. Commonly it is preceded by a growth of herbaceous plants, or vines, followed by poplar and bird cherry; and then, when a suitable seed bed has been prepared by the waste from these trees, the return of the spruce itself takes place.

The fact that young seedlings are so widely distributed through the forest is due in part to the ability of this tree to grow under heavy shade. This does not mean that the spruce will not flourish in the light, but merely that it is tolerant of the heavy cover which is a distinguishing character of the hardwood forest in the Adirondacks and throughout New England. The tolerance of the spruce is not confined to early life, but persists far into middle age. Specimens from 100 to 150 years old, and less than 6 inches in diameter, are common. Such trees have survived on the little sunlight which could penetrate the heavy crowns above them, and, although not in vigorous health, are capable of continuing the struggle to an advanced age. This ability to tolerate heavy shade is common to large numbers of forest trees, among which both the beech and the hard maple excel the spruce, with which they grow; but few trees possess the wonderful capacity of the spruce to recover from long years of suppression and grow almost or quite as vigorously and rapidly after it is ended as though all the conditions of life had been favorable from the beginning. It is to this capacity, more than to any other, that the spruce owes its presence in the Adirondack forests. Slow of growth in youth, and germinating for the most part under heavy shade, the spruce could not survive in the hardwood forest, where it reaches its best development, except by the combination of these two qualities, the ability to bear shade and the power to flourish when the suppression is over as vigorously as though it had never been.

Lumbering, as at present practised in the Adirondacks, affects the forest to its injury because, in the first place, it decreases the number of valuable trees. The spruce, which at best is scattered only here and there through the hardwoods, is removed, and no provision of any kind is made for its reproduction. The less valuable trees remain to perpetuate their kind, and the final effect on the forest is to leave it less valuable in composition and promise than when the lumbering was begun. The trees which are spared by lumbermen at present are the hardwoods, the less valuable conifers, chiefly hemlocks and balsam, and the defective spruce. Underneath the trees the young spruce may live for many years, but in the end they find it exceedingly hard, or in many cases impossible, to penetrate the dense cover of foliage above them and reach the light. Until they do, they must remain stunted and of little value. It often happens by the removal of sound spruce that not enough mature spruce trees remain in any locality to provide seed for the future forest, and in this way the reproduction of spruce is hampered or made impossible. Cutting for pulp does far more harm than cutting for lumber, because it takes a vastly greater number of trees. To reduce the diameter of the smallest tree cut from 10 to 6 inches is to double the number of individuals taken. In addition, the growth which would have taken place in the young spruce trees in the next years is lost, and takes place in the hardwoods instead.

In felling, under the present system, the loss is very serious in broken-top trees, which have been found to gain very slowly in diameter and height as compared with sound specimens, in young trees smashed and destroyed, and in young trees whose soundness and growth is injured by the loss of bark here and there. At present this injury to the capital value of a forest receives no attention. Practical work in the woods has demonstrated that the cost of the care required to prevent this loss is so small as to be altogether insignificant and wholly out of proportion to the value of the result.

In skidding many young trees lose their bark in places by contact with the harness or the logs, and afterward become unsound. Young trees of valuable species are commonly cut to build skidways, when it would be almost as easy to take less valuable kinds. In road-building the destruction of valuable young growth is particularly noticeable. Young spruce is often cut where other species are at hand and would answer the purpose just as well.

In general, the amount of damage done under the present system of lumbering is directly in proportion to the number of trees cut per acre. Almost the whole of this damage is unnecessary, and could easily be prevented at very small expense.

The influence of cutting for logs and pulp wood—not for charcoal—as at present practiced in the Adirondacks, on water supply is small, except as lumbering increases the spread of fires. So few trees are taken per acre in the pine and spruce forests, that, as a rule, the forest cover is but little interrupted; and even where the cut is heaviest it is capable of re-establishing itself within a few years. But lumbering has hitherto been largely responsible, directly or indirectly, for the fires which have ravaged portions of the Adirondacks, and in this sense it has a decided and harmful influence on the flow of streams.

But it would be unfair to condemn all lumbering because the present method is not wholly right. The qualities of the spruce, and the general circumstances which surround its utilization in the Adirondacks, make it plain that better methods are possible from every point of view.

When a piece of ground is fully covered with forest trees the latter stand so close together that they crowd each other and a struggle follows, in which some trees are suppressed and checked in their development and others so shaded that they die, and the rate of growth of every individual in the forest falls behind that of trees in like situations in the open. But while the rapidity of growth of the individual tree is less, the total product is greater than it would be if the ground were covered only with scattered trees, and it is far better in quality.

Mention has already been made of the great vitality of the spruce, and its wonderful capacity to live and grow in dense shade. This power is not restricted to early life, but continues into old age as well. Thus at Ne-Ha-Sa-Ne several trees but 9 inches in diameter were found to have more than 200 annual rings on the stump, and of eighteen spruces with diameters ranging from 8.5 to 9.4 inches, but seven were younger than 150 years, and none were younger than 100. These trees had grown for years crowded and shaded by their more thrifty neighbors. Under such circumstances it is common to find small trees still alive, but with flattened and umbrella-shaped crowns. Even such trees are not beyond the possibility of usefulness. If the shade be removed they will usually begin to grow as vigorously as though they had never been suppressed. If the leading shoot has been killed, which is sometimes the case, a side branch will turn up and take its place, and the growth, although somewhat retarded by the accident, will go rapidly on. Such recuperation after shading not only takes place in small trees, but also in those which are from 15 to 20 feet in height, or even larger. A considerable proportion of all the large spruce in the Aidrondacks is found, on examination, to have passed through this stage. For example, on old windfalls in certain sections, and particularly soft maple flats, many of the old spruces carry clusters of very numerous persistent branches growing close together at 10 or 15 feet above the ground. These branches mark a period when the crown was flattened and umbrella-shaped. The present size of the spruces shows plainly how, when the old trees above them were blown down, they shot up and grew thriftily in spite of the severe circumstances of their youth. It is true that when trees have attained such a size before being set free the injury to the lumber is serious, for the persistent branches entail the loss of a certain amount of clear stuff. If, however, the tree is small when freed it may be covered over in time and lumber of good quality may be produced.

The effect of openings in the forest on vigorous and suppressed trees alike is then to give them more room for development, a larger and better apparatus of roots and leaves for the gathering and digestion of plant food, and so to increase their rate of growth in diameter and height.

The practice of thinning is based on this capacity for increased growth on the part of trees which have been more or less vigorously set free, or, in other words, on the part of the members of a piece of forest which has been thinned. The removal of a certain number of trees from overcrowded woods increases the final product, instead of decreasing it, and an additional intermediate product is obtained from the wood cut in thinning. In this way the total output of a piece of forest in final cuttings and thinnings together is far greater than it could be without silvacultural attention.

In the Adirondacks the forest to be dealt with does not consist of one species, but is a mixture of deciduous and coniferous trees of all ages. The cutting there is governed by the distribution of merchantable timber, and such considerations as have just been described have been left entirely out of account. In this way it happens

TABLE SHOWING THE AMOUNT OF TIMBER IN STANDARDS REMOVED AT FIRST CUTTING, AND PER CENT. OF SMALL TREES LEFT STANDING, WHOSE GROWTH WAS ACCELERATED, ON FOURTEEN SAMPLE PLOTS AT SANTA CLARA, N. Y.

Area of Sample Plot. Acres.	Amount Removed at First Cutting. Standards.	Per Cent. of Small Trees Whose Growth Was Accelerated.
0.8	38.4	42
1	17	31
1	14.2	6
1	14	40
1	13	13
1	11.8	2
1	11.2	20
1	10	38
1	9.8	11
1	4.4	21
1	4.2	11
1	2.6	5
1	1.5	0
1	0.5	0

that a considerable amount of the old spruce may be removed with very little benefit to the young trees of that species. Old birch and maple and other hardwoods may remain, and the effect of the cutting may not be to free any considerable number of young spruce trees from the heavy timber overhead. In other cases the merchantable spruce may stand in groups, whose removal will have little or no effect on the young trees left standing. The best results are attained only when the timber removed was well distributed above the young trees. Where but a single merchantable species is cut from the mixed forest, this can only exceptionally be the case. Just what the effect of the cutting will be on the remaining trees depends, then, on the character of all the species in mixture, as well as on the amount and distribution of the old trees which were removed. It is therefore difficult to reach figures more than approximately exact, and it is fortunate that such figures, however desirable, are not absolutely essential. The following method of study was employed as a means of attacking this question: On areas of definite size, usually of 1 acre each, all trees which would make pulp wood were cut and analyzed so that their exact contents was known. The stumps and tops of trees taken at the first cut, and the distance between them, were then measured, and the amount of timber removed at that time was thus closely ascertained. All trees left by the first and second cuts were then carefully measured with calipers. The date of the first cut was known, and it served, together with the measurements and counting of rings carried out in the second cut, to re-establish the history of the stand for about thirty years back. Fourteen such small plots were laid off, and over 2,000 trees were carefully analyzed. The first table gives the per cent. of small trees whose growth was found to have been increased by the cutting of the old trees. It will be noticed that the causes of irregularity mentioned above have acted so powerfully as to prevent the statement of any exact ratio between the per cent. of trees affected and the amount of timber removed. In general, the former may be taken at about 20 per cent.

TABLE SHOWING NUMBER OF SPRUCE FOR EACH DIAMETER, TOTAL AND AVERAGE, ON 1047 ACRES AT NE-HA-SA-NE PARK.

Diameter in Inches.	Number of Spruce.	Average per Acre.
Under 2	163,718	156.3
2	23,283	22.2
3	21,144	20.2
4	19,783	18.9
5	14,560	13.1
6	12,811	12 3
7	10,167	9.7
8	8,387	8.0
9	7,085	6.8
10	6,692	6.4
11	5,242	5.0
12	4,64 .	4.4
13	3,785	3 6
14	5,229	5.1
15	2,679	2.6
16	1,990	1.9
17	1,655	1.6
18	1,132	1.1
19	721	.69
20	507	.48
21	326	.31
22	184	.18
23	114	.109
24	55	.0'3
25	35	.033
26	15	.014
27	12	011
28	7	.....
29	0	... ..
30	1	.....
31	2	.....
32	1	.....
34	1	.....

Total over 2 inches 150,228.

The abundant reproduction of the spruce

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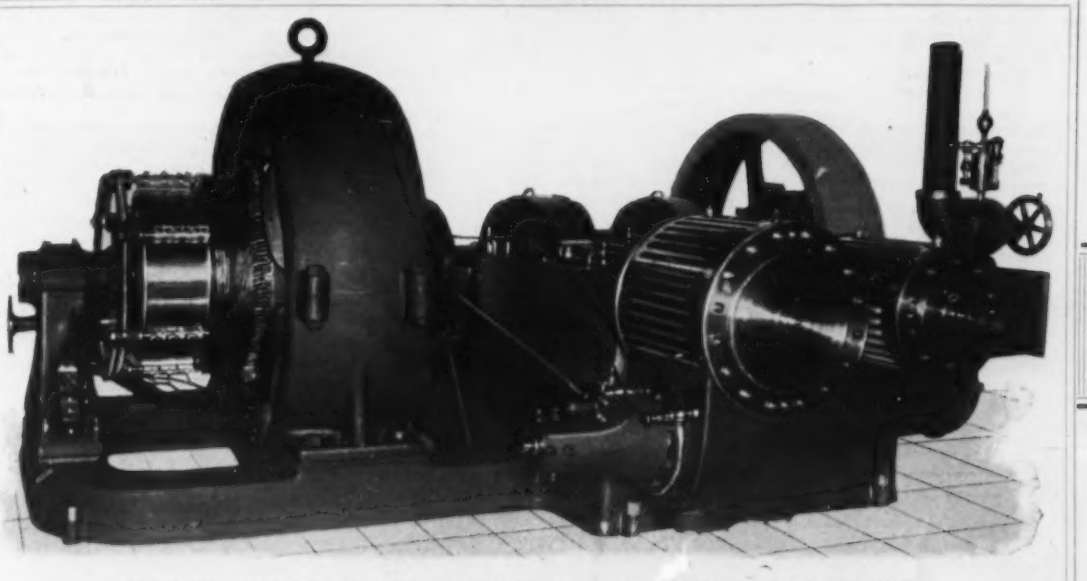

COMPOUND AMERICAN-BALL ENGINE AND 150 K. W. DIRECT-CONNECTED GENERATOR.
Installed in the Geo. W. Munroe Publishing Establishment, New York City.

The American Engine Co.
Bound Brook, New Jersey.

"The Fourdrinier Machines of the Cliff Paper Co., Niagara Falls, are operated by our specially designed motors, which are highly endorsed by the president of the Co." Mr. Arthur Hastings, in an article in The Paper Trade Journal's Anniversary Number.

and its ability to survive under heavy shade are the essential reasons why trees of every diameter are present throughout the forest. The relative number in the different diameter classes is of the first importance in forest management, because upon it depends primarily the number of trees which will be ready for the axe at any future time. Thus, a continuous yield is difficult or impossible without a complete series of age classes. Data have been collected which furnish a very complete study of the diameter classes of the Adirondack spruce. The average number of trees of each diameter down to 2 inches, as well as the average number of seedlings and saplings under 2 inches, but large enough to be seen at a glance, has been determined from surveys covering more than 1,000 acres in Ne-Ha-Sa-Ne Park. The average numbers for the whole area studied are given in the preceding table.

From this table it appears that a regular diminishing gradation exists in the number of trees per acre as we pass from small diameters to large. It is upon this proportion that predictions as to the future yield of lands once cut over are based, and upon a correct interpretation of it depends, to a very considerable degree, the reliability of the figures that are given.

A prediction of the future stand of cut-over spruce land cannot disregard, if it is to be reliable, the number of trees which will die between the cuttings. To ascertain this figure the dead spruce were calipered on 843 acres. The result gives an average of about three dead trees per acre.

The table which is to give full details has not yet been prepared.

We have now glanced at the general character of the spruce and at some of the main facts which influence its growth. The resultant of all these facts is well expressed in the average increase in diameter of trees growing naturally in the original forest, as shown in the following table. This table is restricted to trees of approximately merchantable size, and its results are exceedingly interesting. They differ conspicuously from those given by the present writer in the report made for Dr. Webb and published in the final report of the special committee of the Assembly, whose chairman was Hon. Thomas A. Wagstaff, and whose report was submitted in 1897. The rate of growth there was considerably more rapid than that which is now found to exist. This further study makes it evident that the estimate previously reached was too large.

RATE OF GROWTH IN DIAMETER FOR THE LAST TEN YEARS, FROM MEASUREMENTS OF 300 TREES AT NE-HA-SA-NE-PARK.

On Trees in Diameter Inches.	Mean Annual Growth, Diameter, Inches.	No Years Required to Grow One Inch
9	.1	10
10	.12	8
11	.14	7
12	12	8
13	.13	8
14	.14	7
15	.11	9
16	.11	9
17	.11	9
18	.11	9
19	.12	8
20	.10	10
21	.11	9
22	.08	12
23	.10	10
24	.10	10
27	.14	7

Some Facts in Hydraulics.

BY CLEMENS HERSCHEL.

Mr. President and Members of the American Paper and Pulp Association—My first impulse, on finding myself in your presence, is to express to you my great pleasure in thus being allowed to address the association. This is made the greater from the fact that I have long had a partial feeling for paper makers. When I left the city of Holyoke, Mass., in 1889, after having been in charge of the water power of that paper city for ten years, I believe I carried with me the esteem and friendship of about every manufacturer there. This I had striven to attain, and when it is considered that I had been the means of increasing the value of the Holyoke Water Power Company's plant by a very large sum of money, the annual interest on which sum, in the shape of additional water rents, remained thereafter to be paid mainly by the paper makers of the city, the circumstance above stated is quite as creditable to them as it may be professionally to me. I came to know paper makers quite well, having been their confidential adviser in Holyoke during my stay there in many a matter hydraulical, and as a result it gives me great pleasure to attempt a similar office to a larger group of the same fraternity here to-day.

Your respected president has given me for subject practical applied hydraulics, and if you will bear with my shortcoming I may succeed in making the subject of so abstruse title a little plainer, in more or less of its applications, as a mill man encounters them.

It has been said that a water power deed is ordinarily the record of a transaction in which the buyer did not know what he was buying, the seller did not know what he was selling, and the lawyers who passed the deed did not know what they were doing. The this picture is in many cases not overdrawn the deeds themselves are often the best evidence. With such a beginning, no wonder that the property bought is frequently not utilized to its full capacity, and small wonder that its possession not infrequently gives rise to discontent, to neighborly quarrels, to nigh endless litigation. Let us see if some of the definitions involved cannot be made clear, and more readily assimilated by him who reads as he runs than has frequently been the case.

I begin in the curious way of first defining what is a foot, lineal measure. From that I propose to pass to square feet, to cubic feet, to cubic feet per second, and to a horse-power. Any man who understands well and fully what is a horse-power will have little difficulty in fully utilizing his own water power, or in the purchase and sale of water powers. But such men are rare; and rarer than one would suppose; and some men, learned in other respects, can never be made to understand the term. Many years ago I was engaged as expert in a suit for damages, caused by a diversion of water, and the senior counsel, an ex-judge of the Supreme Court of Massachusetts, a most able judge and lawyer, asked me to come to his office to talk the case over. His office was in a sunny nook of the old time then still aristocratic Pemberton square in Boston, comfortably fitted with old farmer's rocking chairs, open fireplaces—in short, a lawyer's office of the old school. "Now," said he, "we are here alone, and comfortably situated, and I want you to explain to me just what is a horse-power." Well, I was fond of the man and of my professional duties, and I did my best. I talked and used illustrations; demonstrations were indulged in, as also my powers of reasoning. I enlisted in the cause the scientific uses of the imagination, and thus went on the afternoon's struggle to have the good old gentleman thoroughly grasp the meaning of the term horse-power. He was an attentive listener and tried as hard to receive as I was trying to give; but the final result was that I carried away with me the impression that the judge did not know what was a horse-power.

I hope I have become more skillful and can do better here to-day, and no doubt most or all of you are better prepared by past training than was the judge. At all events the business of expounding horse-power appears to be still with us, and I will proceed.

A foot, then, in the United States, as adopted by the Treasury Department, but never yet legalized by act of Congress, is one-third part of the distance between the twenty-seventh and the sixty-third inch mark of a brass scale 82 inches long, made in London, in the custody of the United States Coast Survey, and when the temperature of this scale is 62° Fahr. This being a foot, it is easy to see that to measure the length of any object in feet and fractions of a foot becomes a difficult matter. It is easy enough to approximate to such a measurement, but to do it exactly becomes—I use the term advisedly—impossible. All measurements, even of so simple a kind as linear measurements, are only approximations to a greater or less degree, according to the expense one may incur in performing them. Measuring fronts on Broadway is done with one degree of accuracy, and measuring the sides of wood lots in Vermont is done with another. We may say that a fraction of 1 per cent. of accuracy can be readily attained in such measurements, where precision is sought.

Naturally the percentage of ordinary error is increased when square feet are to be measured, and again increased in measuring cubic feet.

We now come to the consideration of cubic feet per second, the only proper measure of flowing water in countries that use English measures, and to the proper degree of accuracy of such gaugings.

If a person should hold a box capable of containing 1 cubic foot under a stream of water, and should find that it filled up in 1 second of time, it is very evident that that stream of water consisted of 1 cubic foot per second. This sounds dreadfully trite, and yet I have found from long experience that mystery is thrust upon the subject of the measurement of water when ordinary plain thinking should make it plain to all. This idea then of catching the stream of water in a box, or other measuring tank, during a certain time, lies at the foundation of all proper measures of running water. A definition of cubic feet per second is definite, as you can readily see, whereas all other makeshifts should be ignored. Think of the evil that has been done in lumbering up old deeds and contracts with terms of which no one can give the exact meaning, such as "runs of stone," "square inches of water," "enough water to fill a 12-inch pipe." Even so vague a measure as "sufficient to run a fulling mill" exists in Massachusetts legal history. Suppose we apply the same lack of acumen and the same density of ignorance of the proprieties to deeding land, and we would get such measures as "a pasture for a flock of sheep," "a farm measuring one-quarter of a mile," "enough land to build a house and barn upon," "sufficient land upon which to raise a crop of corn." These sets of measures for streams of water and for land are, however, no more improper in the one case than in the other.

I come back to the box holding 1 cubic foot and filled by a stream of water running into it for one second of time. Such a stream discharges 1 cubic foot per second. If the box should contain 20 cubic feet, and be filled in one second, we would have 20 cubic feet per second. If the box contained 10 cubic feet, and were filled in five seconds, we would have 2 cubic feet per second, and so on. Some one may say that catching streams of water in a box, while the time in which the box is filled is measured, is not often practicable. But the method is practicable in more cases than one would suppose, being ignored possibly because of its very simplicity. And all accurate systems of measuring water are based, somewhere in the ascending line of their proof, on this method of a measuring tank and a stop watch, crudely represented by the illustration above given of the box holding 1 cubic foot and the stream running into it for one second of time. Thus, the well-known experiments of my former revered chief and ever-to-be-remembered master and teacher, the late James B. Francis, of Lowell, on weirs made the weir one of the standard methods of measuring water, because Mr. Francis, nigh fifty years ago, measured the amount of water discharged over certain weirs into an old canal lock at Lowell, during measured times, and because this was done with most painstaking accuracy in all its parts and elements. A weir I might explain to some present is a refined sort of overflow, or wasteway dam, being in its exact form a sharp metal edge, set up level on top, and perpendicularly in and squarely across the stream of water to be measured. Mr. Francis himself went a step further, and established another method of measuring water—the method of floating tubes—by allowing the same quantities of water to flow over a weir, which he then measured by means of floating tubes. He knew how many cubic feet per second were going over the weir from his experiments in filling the old canal lock used as a measuring basin, and thus was enabled to establish formulæ for the use of floating tubes, the tubes in the second set of experiments measuring the same stream of water that was at the same time flowing over the weir. During my stay in Holyoke I established the third practical method of measuring large streams of water, by the use of what I named the Venturi meter, in both of these ways. The Venturi meter, I might explain, consists of a wooden or metal tube or penstock, of proper shape and diameter, through which the water flows and with it goes a register when a continuous measurement is desired, quantities, in that case, being read off on dials as on an ordinary small gas or water meter. A 12-inch meter was allowed to fill a large masonry tank in the Holyoke testing flume during accurately measured periods of time and a 108-inch meter was allowed to discharge the water passing over it, over a weir, and the comparison between the two was then made. Since then many other such tests of the Venturi meter have been made, some on works under my charge, some by other engineers and water-works superintendents, and the present demand for these meters in the United States and abroad certainly justifies the statement that this method of metering water is an established method. As long as water remains water and gravity remains gravity, a repetition of the apparatus—weir, tube or meter—used in the original experiments that have been detailed must reproduce the original results and thus must constitute an accurate method of measuring water.

How accurate? We have seen that absolute precision is unattainable to mortal man in any measurement. To put it tersely, it is impossible to make a rod of metal exactly 1 foot long. If there were such a rod, no one could assert the fact. To make a solid or a hollow cubic foot, within a half or possibly 1 per cent. of error, is equally impossible. How about cubic feet per second of running water? A single measurement of such, if positive within 2 per cent., is a good one. Wherefore I venture to add that no one should expect the impossible, by expecting no sensible variations in a series of water measurements, but should be content with averages. If only enough fairly accurate measurements are thus averaged the result may be made to attain any desired degree of absolute accuracy. Careful work, never ending painstaking, a check by different methods upon each other, a reasonable concordance of results among themselves, sums of measurements extending over long periods of time, or averages, these are the elements that go to make up measurements of running water that may be trusted. I should add that in the administration of water power and of water supply companies, as I have been taught to conduct them, the seller gives the buyer at the very outset the benefit of any doubt there may be attaching to any measurement.

Thus far the measurements considered come within range of our sense. Roughly we can have a judgment as to their results by the exercise of our senses. It is given us to estimate lengths, areas, volumes, even weights so long as we can lift them, and in a crude degree and by practice, we may even estimate cubic feet of water per second visibly flowing in a channel. But when we pass to the next measure, that of horse-power, the aid of the senses forsakes us nigh totally. I have tried to imagine a way of estimating only a small fraction of a horse-power by the senses and give you the result as a curiosity and as an illustration. If we had a small shaft revolving, say a sewing machine shaft, and conveying a small fraction of a horse-power, then by gripping the shaft with both hands we might stop or retard its motion, and if an *equal grip* would arrest the motion of one such shaft more than another, the one stopped most, that is most retarded, would be conveying the lesser power. The method has presumably no practical value whatever, though its statement at once illustrates that the new elements of speed and of force or weight in motion have entered into the consideration of our unit of measurement.

A horse-power is ordinarily stated to be 33,000 pounds lifted 1 foot high in a minute, and, as the statement of a formula, that will do well enough. But to become acquainted with the nature of the thing defined more thought and words are necessary. The term had its origin with James Watt, the inventor of the steam engine, properly so called. He and his partner, Boulton, wanted a measure of the power of their engines to be offered for sale, and, having noted that on a straight pull a stout horse, for a short space of time, could lift a weight of 550 pounds, say out of a well, at a speed of 1 foot high in a second, they called that a horse-power. This is a product of weight into speed or rate of motion, speed being itself composed of linear length and the time taken to pass over it. So long as the product of feet and of pounds raised per second remains the same the horse-power is the same, for we have just seen that 550 foot-pounds per second is the same as 33,000 foot-pounds in sixty seconds, or in a minute; 33,000 foot-pounds in sixty seconds being 550 foot-pounds in one second. Similarly 1,100 pounds 1 foot high in two seconds, or 550 pounds 2 feet high in two seconds; or 33,000 pounds 3 feet high in three minutes, are all equal to one horse-power, as arbitrarily established to be equal to the power of a horse by James Watt. Now, how does a waterfall represent horse's power? To understand this it is but necessary to recur to a consideration of the origin of the term horse-power, as above described—to the stout horse pulling a dead weight at a certain speed up out of a well. If, instead of the powers of contraction of the horse's muscles, we were to substitute to raise our dead weight out of its well a live weight falling into another well, this live weight being sufficiently heavy and so connected that it will cause the dead weight to come up out of its well as fast as the horse originally brought it up, the apparatus would still be exercising 1 horse-power. Now substitute the weight of a stream of water for what I have called a live weight and we have a stream of water exercising continuous horse's power. Water weighs about 62½ pounds per cubic foot, and theoretically, therefore, a cubic foot of water falling through a space of 1 foot in one second should raise 62½ pounds of dead weight 1 foot high in a second; or, a horse-power, being 550 foot-pounds per second, is about 8.8 cubic feet of water per second on 1 foot fall. Practically, it is generally nearly 12 such cubic feet per second on 1 foot fall, owing to unavoidable imperfections in water motors and in water connections.

If I have made myself clear, you can see at once the importance of using all the attainable fall in the development of a water privilege. The space the water descends is a measure of the space an equal weight could theoretically be made to ascend during the same time; in other words, it is a direct measure of the horse-power. The same water on a 20-foot fall has twice the power it would have on a 10-foot fall. And, as power is worth so much per annum, a gain of fall for power that is in constant use is warranted at an expenditure whose interest charges are equal to the value of the horse-power gained. To gain a 12-hour horse-power or a 24-hour horse-power, worth say $20 or $40 per annum, an expenditure of nigh $500 or $1,000 in raising the dam, gaining fall in the head race or in the tail race, or for the purchase of a better wheel and its successors, or their gearing, is justifiable.

We will now suppose the paper maker supplied with water-power rights and with its appurtenant water-power machinery. Either he owns the dam and canals in whole or in part, or else he has bought water rights of a water-power company and pays rent for his power. There is, however, still another arrangement, unique so far as I know, and as admirable as it is unique, illustrated by the eleven oldest corporations at Lowell, Mass., who form a mutual water-power company and pay rent to it; in other words, to themselves.

The paper maker that owns his own water-power plant may have troubles that his brethren of the tenant class know nothing of, but the latter can return the compliment, and those who own a water power in conjunction with only one or more other owners can have a tale of their own to unfold, again different from and mayhap more woeful than those to be told by the other two classes. Nevertheless the sole owner of a water-power privilege is like a captain and ship owner aboard his ship, and him we will leave in these remarks to his own devices. He generally lives a peaceful life. But so soon as he sells a portion of his water-power property to another trouble begins. At all events, and as a rule, it is only when that state of affairs has begun and has assumed an acute stage that my acquaintance with such plants commences. You will remember what I said at the outset about deeds for water power. As a result of my life's experience it has been impressed upon me that very much the greater part of water quarrels and of litigation on water power sites would have been or would be avoided if the deeds for such property had been or were henceforth to be drawn by more competent hands. In Italy, a country which is the birthplace of all our original knowledge of hydraulics, and which has had thousands of years of experience in practical hydraulics where we have had scores, the rule is that water contracts are drawn up and adjudicated upon by so-called "periti," or, as we would say, experts, a class which may be called a cross between or a combination of a lawyer and a hydraulic engineer. Practical hydraulics enters there much more deeply into the everyday life of the people than with us, inasmuch as their whole system of agriculture has for thousands of years depended on irrigation. And as a result of this wealth of experience and of the refining and improving effect of time, we find practical hydraulics treated differently and by a different set of men in the daily conduct of their affairs than are their other matters of contracts, of deeds and leases and of litigation. My life's experience has firmly convinced me that to avoid a depreciation of our water-power property it is absolutely necessary that a similar method of protecting and administering it in this country be adopted. Prevention must be allowed to do its work, where now so much is either endured or else is relegated to the domain of cure.

It is much easier to properly administer a large water-power privilege than a small one, as you may presently see. I commence, therefore, with some remarks on the peaceful and just administration of a large water-power plant. Of this we may distinguish three different kinds, the mutual plan of management already referred to as existing in Lowell, Mass.; a stock company owning the water-power plant, as, for example, in Lawrence, Mass.; and a stock company owning a central power station and delivering power instead of water rights.

This last-named system has long existed in Europe, where the density of population and in some cases the lack of rights of eminent domain for the taking of the land deeded to establish the water-power plant have caused the central power station plan to be the only one that could practically be adopted. Lately, and with the advent of the electrical distribution of power, this central power station plan has found lodgment also in the United States and in Canada, the pioneer plant of this sort in America being that of the Niagara Falls Company, of Niagara Falls, N. Y. The time may come when the same class of questions will arise in the administration of the distribution of power as are now met with in the distribution of water for power purposes, but so far the parallel case is one of the distribution of water for domestic purposes or the distribution of gas. But we can already imagine a number of manufacturers all drawing electric power from a huge accumulator battery, or a dozen factories, in series, on one set of wires, and in that way living under the embarrassing communistic circumstances that are so well known to the present owners or tenants on the ordinary system of head canals and tail races. This sort of communists must have law and order kept among them by some proper form of management if their common property, no less than their individual rights, is to be maintained, while the ordinary forms of law will suffice to keep order as between a mere manufacturer of power, like the owner of the central power station as so far developed, and his purchasers of power; for which reason I consider this last named case no more at this time.

I have just alluded to the subtle distinction between the relation of an owner or tenant on a canal of an American water power plant to his neighbors on the same canal, and his relations to and with all other men in the community in which he lives. Toward the former he unfortunately bears the relation of one owning property in common with them, for they all draw water from a common receptacle, and I venture to assert that if Mr. Bellamy had ever had six months' experience as the manager of such a canal some of his chapters would never have been written. In some form this communistic element in the design and the operation of such works must be reckoned with, for weak human nature is not fitted to be the main attribute of a communist as yet, so far as my observation and experience serve me. Communists must have rules devised suited to their especial case, to the end that order may be kept among them, for the common statute law was not made for them.

I will illustrate these necessary methods of regulation by describing the government in force on the canals at Lowell and at Lawrence, Mass., the one illustrating the highest type of communism, the other a first-class management by a water power company.

The eleven older mill corporations of Lowell some fifty years ago bought out all the stock of the proprietors of locks and canals on Merrimac River, this being the company then owing the water power canals at Lowell. They surrendered all their rights to water power, and then caused to be issued new leases of precisely the same form and of the same date. The stock of the water power company was at the same time arranged to be held in the exact proportion of the water rights, there called mill powers, held by each of these eleven manufacturing corporations. In practice, the local agents of the manufacturing corporations form the board of directors of the water power company, and the local agent of the water power company is also the hydraulic engineer of the company, and has always been an able one. He is also present by virtue of his office at the meetings of these directors. When it is considered how irregularly the business of boards of directors is usually done, it will be seen that no proper amount of influence can be exerted on such a body except by members of it, or else by an officer of the company entitled to be present at their meetings, especially in matters so technical as the administration of water power.

The agent of such a water power company cannot fail to become the general arbitrator of small differences that may arise from day to day among his group of communists, under the arrangement as above sketched in general lines. The system has been eminently successful for keeping the peace for the last fifty years among water users at Lowell, which is the same thing as saying that for fifty years it has maintained the full value of the Lowell water power property.

At Lawrence the Essex Company is the owner of the water power, and the stock is still owned by the original subscribers, or by their successors by private sale or inheritance. The local agent has always been a skillful hydraulic engineer. Both here and at Lowell the measuring of water has always been considered a judicial act, something like those of a public weigher. The treasurer of the corporation has in both places always been a non-resident, and in no wise concerned in the judicial operations just referred to. Any other arrangement would manifestly be grossly improper. The hydraulic engineer who goes out to decide between corporations on questions involving the payment of money, from the one to the other should, like Cæsar's wife, not only be able and honest but also be above suspicion.

I have often struggled with the problem of how best to manage a small water power, divided up among only five or six or more corporations. These cannot afford to engage the services of sufficient men, and skillful enough to carry on daily measurements of the amounts of water drawn by each corporation, as this work is done on all well managed power plants, and as must be done to keep the peace and keep up the value of each individual user's property.

It has been and can be done by a competent hydraulic engineer living at some distance, if he be allowed sufficient access to the wheels of the manufacturers. A water wheel may be converted into a water meter, and at mere nominal expense if it be sent to a testing flume before it is set in the mill. It was with a forethought of its being used for just such purposes that the Holyoke Water Power Company built, under my direction, its testing flume in 1881, and the record of nearly two wheels per week tested there during the past year shows that it meets, as the agents say, a long-felt want. A skillful hydraulic engineer should have no difficulty in so arranging for the discharge record of a tested water wheel that any intelligent bookkeeper or

carpenter could keep a daily record of either water discharged, or of power delivered, or both, according to instructions received.

Mr. President and gentlemen, I have thus spoken to you as the ideas have come to me without much rhetorical effort, and, if you will pardon the deed and its confession, without much preparation. If you have caught glimpses here and there of ideas worthy of being utilized in the conduct of your hydraulic affairs my wishes will have been fulfilled.

Use of Electric Motors in Paper Making.

BY PROF. LOUIS BELL, PH. D.

Every special industry presents to the electrical engineer a series of problems peculiar to itself. We have fortunately passed out of the period during which electric motors were regarded as the craftsmen of an omnipotent mystery. The only halo now surrounding them is occasionally noted about the commutator with remarks far from suggesting reverence. To-day electric power must stand upon its own merits and be accepted or rejected as it is or is not well fitted for the purpose in hand.

Speaking broadly, the fewer intermediaries between the point at which power is generated and that at which it is utilized, the better for economy so far as power is concerned. And, therefore, if an electric motor is thrust between the prime mover and its work it must show good cause for its presence. The energy necessarily lost in it must be compensated by a greater saving of energy somewhere else, or by some economy in time or labor sufficient to be worth the while.

Whenever electric motors have proved important adjuncts in any manufacturing process it has usually been for one or more of the three following reasons, each of them definite and sufficient. First, they may have enabled a cheap prime mover to be substituted for a costly one. Second, they may have materially reduced the energy lost between the prime mover and the point at which its power must be applied. Third, through their characteristic facility of application they may have been able to replace manual labor at some point in the process of manufacture. Beyond this electricity may have an intrinsic value as the source of new processes, but electric power, as such, takes in these no part.

As types of these particular functions of electric power may be mentioned, first, the transmission of energy from water power, thus replacing steam engines; second, the use of motors to replace long lines of shafting, belting and gearing; and, third, electric machine tools, cranes and shop tramways.

In any particular art these several items apply with very varied force and the vital point of interest here is to see if they may have a direct bearing on operative economy in the great paper-making industry.

In discussing this general problem we must remember that no two mills are exactly alike in their requirements any more than in their situations. One may be so circumstanced and may be working in such a way as to make the securing of cheaper motive power of paramount importance; another may have this already but may need very badly efficient means of power distribution, while a third may need labor-saving appliances more than anything else. Each of these conditions requires different treatment, and, what is more, each case is likely to need special treatment of its own. The fact that a certain plant gives good results when electrically equipped in a certain way is of no value whatever in determining a similar equipment for your particular mills. It merely shows that a properly planned electrical equipment works well, a fact which nobody in the present state of the art is inclined to deny. In fact, the same arrangements elsewhere may be anything but desirable, for in making a Chinese copy one is quite sure to copy all the mistakes of the original and probably will add some of his own. Beware, then, of electrical panaceas—one might as well take codliver oil for a toothache as to apply some beautiful system of electrical driving to a place in which it is not needed.

In this year of grace 1898 we must regard the electric motor merely as an exceedingly convenient and efficient means of supplying power where it is wanted, to be used like a belt or a shaft where it will best serve the purpose—and nowhere else. Fortunately too, many kinds and makes of electric motors are readily obtainable, most of them thoroughly good and reliable. In certain places some varieties of the genus motor are better than others, just as in some cases gearing is better than belting. Selection must be made with reference to fitness for the purpose in hand. The most that can be done here is to point out the conditions that must be met and to indicate some of the ways in which motors can be advantageously employed in the paper industry.

Let us first take up the matter of cheap motive power and its bearing on the use of electrical machinery. At the present the principal raw material used in paper making is wood, and the mill must generally get within easy range of its wood supply, whether the situation is otherwise convenient or not.

As grass, straw, cornstalks and other varieties of cellulose become more important in paper making the forest is less important, but in all cases the raw material is somewhat troublesome and costly to transport, and good facilities for getting it cheaply are of fundamental importance. Secondly, the power for working up this material must be easily obtained and at least a moderate water supply is necessary in the process. Finally, aside from all questions of power, heat must be supplied at certain stages of the operations. Now this concentration of cheap wood, ready power and cheap fuel is not altogether easy to secure. It has landed many paper mills in very out-of-the-way places and forced them, whenever possible, to locate at some point where wood is plenty and water power is available.

The consequence is that numerous mills have to face the dilemma of paying heavy freight bills on their wood or producing their power by steam where the cost of coal is high. Inasmuch as steam is needed in the process of manufacture it is quite usual to drive part of the plant, particularly the Fourdrinier machines, by engines, using the exhaust steam for heating purposes.

Now, at the risk of being accused of "teaching my grandmother to suck eggs," I am going to enter a vigorous protest against this practice. It is most emphatically not true that steam thus obtained is cheaply obtained. It implies in the first place very uneconomical use of the engines, and, in the second place, it virtually amounts to generating steam for heating at a high pressure and reducing this to 8 or 10 pounds by the use of a very expensive reducing valve. High pressure steam has its legitimate uses for heating, but this is not one of them. It is well within bounds to say that the fuel bill for the power is doubled by thus working the engines non-condensing with considerable back pressure, and the cost of the steam used for the heating is thus really a most unpleasant item. For example, take a plant requiring 10,000-hp. hours per day, and 50,000 pounds of steam for heating purposes. If worked in the common way there will be required for power not less than 300,000 pounds of steam, demanding burning, say, 20 tons of coal under the boilers. Working condensing the same power can be obtained for about 180,000 pounds of steam, say for 12 tons of coal, while the extra 50,000 pounds of steam for heating calls for about 3 tons more, making a total of 15 tons daily. Now, in Yankeedom, whence I hail, 5 tons of coal per day is usually considered worth saving, to say nothing of lessening the boiler capacity required by nearly one-half. A demand for heating capacity so great as to render the power generation a mere accessory would only show very bad utilization of the heat.

The sum and substance of this matter is that running engines in an uneconomical manner is a bad thing first, last and always, none the less bad when hidden behind losses still greater.

Now, the bearing of this so far as electrical operation is concerned is to indicate the use of steam for heating purposes only whenever water power is fairly available. And, in my opinion, the first and greatest use of electrical apparatus in paper making is in supplying cheap motive power from waterfalls, enabling the mills to be located at points favorably situated with respect to cheap raw material and easy shipment of product. These advantages once gained the power can be delivered from the nearest available waterfall at a cost generally lower than the local cost of steam power.

It must be distinctly remembered that power thus transmitted electrically is not at all necessarily cheaper than steam power, but in a very large number of cases it is. From the investigation of probably several hundred propositions of this kind, I feel well within the bounds of truth in saying that with coal at about $3.00 per ton the electrical transmission of 500 horse-power or more from an average water-power anywhere within a radius of 15 miles will pay nine times out of ten. This is the case with power transmitted for ordinary purposes, and when, as in paper making, power is often used continuously throughout the twenty-four hours, the conditions become even more favorable for electric working.

At the present time there are above a hundred electrical power transmission plants operated from water powers in this country alone. A number of them have been working for five years or more, and I have yet to learn of a single case in which these plants have been unable to compete with steam power on satisfactory terms, save in the case of some very large steam plants. Transmission has uniformly proved successful, both in the matter of cost and in reliability, which in many industries is quite as important. And in paper-making regions water powers can generally be more cheaply secured and developed than when they are located near a city which furnishes in itself a good market for power. I am glad to say that in a few instances transmitted power is actually in use in paper mills and all the reports received seem to indicate the success that was to be anticipated. There is nothing experimental in electrical power transmission under ordinary circumstances. The apparatus as now constructed is as manageable and reliable as steam apparatus and may be installed with the same assurance of success. Until within the past three or four years one would have hesitated to advise driving from water power, either directly or indirectly, any machinery requiring uniform speed at varying load. Now, however, water wheel governors are regularly in use which are able to hold the speed with an exactness quite comparable with the governing of a good engine. There are few places where uniformity of speed is more highly valued than in a cotton mill, and there are now a half dozen large mills relying entirely on electrically transmitted power—and using it because it is actually cheaper than steam power, although some of the very best steam practice is to be found in the cotton industry.

With plenty of general experience as a guide, there is no good reason why a paper mill, wherever the situation is favorable, should not derive all its motive power from energy electrically transmitted, and with great improvement in economy.

An ideal situation would be somewhat as follows: Our mill should be situated within easy distance of a good wood supply, if wood is the raw material used. If it is actually in the forest country so much the better; if not, the supply should be accessible, if possible via more than one railroad, to make the adjustment of freight charges a trifle easier. For the same reason, two roads out for the finished product are desirable.

Next, a good water supply should be at least within easy pumping distance, and fuel, coal, or wood, if wood is cheaper, should be at a fairly reasonable price. Now, as to power, it is desirable to get within 10 or 15 miles of a good water privilege. If one can locate right at the water power without sacrificing anything material in the other respects mentioned, why so much the better; but the chances are against it.

In point of fact, in electrical transmission work the distance of transmission within the limits suggested is not an important consideration, for under such circumstances the line is the least expensive portion of the plant. Having secured the water power, develop it, and put in an electrical transmission plant to deliver at the mill all the power required for every purpose. The steam plant is then restricted to the very simple requirements of a boiler equipment for heating only, and the fuel bill is correspondingly reduced to its lowest terms. Then every part of the mill would be driven by electric motors, from the log-handling machinery at one end of the process to the winding rolls at the other. The procedure at first seems indirect, but the gain is twofold, and by no means small. In the first place, great freedom in location is secured—a freedom which in many cases may mean the saving of many thousands of dollars per year in freight bills alone. Second, whatever power is required by the mill is obtained at a lower cost than would be otherwise possible. And to pay for these advantages you are confronted by the cost of the power plant.

I can in no way better emphasize the dollar and cent side of the problem than by making an estimate for just such a transmission, a perfectly typical case of the kind. Let us assume that one of you has a mill which requires, say, 1,000 horse-power delivered continuously for all purposes. Near the proposed site of the mill there is merely a stream big enough to supply water for general purposes, but 10 miles away is a good water power which can be secured without unreasonable expense. What will be the cost of the power-transmission plant necessary to do the work?

To begin at the power house, we must allow, say, 1,000 kilowatts in capacity, with preferably a generator in reserve, say three 500-kw direct-connected machines, if the speed of the wheels will allow. The market price of such machines, complete with station equipments, and wound for 5,000 or 6,000 volts, including installation, will not exceed $10,000 each. It is almost unnecessary to state that for a transmission of this length one of the polyphase systems would always be installed. The present tendency is toward high-voltage generators, connected directly to the line for such cases, although low-voltage generators with raising transformers can be obtained for not far from the same price. In any event, reducing transformers for 1,000 horse-power would have to be installed at

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the mill, in large units of which the aggregate cost would not exceed $5,000 to $6,000. The 1,000 horse-power in motors would be needed for driving the various parts of the mill, and assuming units of 100 horse-power or more the probable cost of these motors would be $15,000 to $20,000, depending somewhat on the size and speed of the various units. This completes the necessary electrical machinery. The line, assuming say 6,000 volts delivered and 10 or 12 per cent. drop, could be erected with all copper up for less than $20,000. Altogether, the machines at both ends of the line and the line itself could be installed, including a suitable station, for about $80,000; under favorable conditions for somewhat less.

The cost of the water privilege and the necessary hydraulic work is the most uncertain factor in working out any assumed case of power transmission. It may fall even to $25 or $30 per horse-power, and it may rise to $150 or $200. Taking the general average of powers in regions where they have not yet acquired an artificial value by proximity to towns, one may say without being widely astray that $75 per horse-power will cover the necessary expense. With a considerable head this figure will be somewhat reduced.

For a rough estimate of the hydraulic cost in the case in hand, we shall be fairly near the mark in doubling the cost of the electrical part of the equipment, making $160,000 as the total investment in the power plant for furnishing 1,000 horse-power day and night. A brief expense estimate will show how important a saving can be effected by this utilization of electric power.

This figure of $180,000 is certainly conservative enough, since I have in mind one plant with a generating station of 1,000 horse-power which was installed complete, including distribution lines to the amount of $15,000, but no motors, for less than $125,000, and this at a time when electrical machinery was considerably more costly than at present.

Now, as to operating expense the figures are not difficult to secure. In the first place we will allow for interest on the investment at 6 per cent., and will charge annually 4 per cent. to the credit of a sinking fund, for depreciation or replacement. Then we will add 2 per cent. for insurance and taxes—certainly an ample allowance. The total annual charge due to these items then becomes $21,600. We can then make up the regular operating charges about as follows: Labor, eight men and team, $6,500; supplies and general maintenance, $5,000. These figures are more than ample for any ordinary case. Summing them, we arrive at $33,100 as the total annual cost of 1,000 horse-power for twenty-four hours per day, which brings the charge per horse-power year down to $33.10. This power generated by steam, with coal at say $3 per ton, using the non-condensing engines too often employed, would cost at least double the amount mentioned, and even with a first-class steam plant the cost would fall little, if any, below $50 per year. In other words, the net yearly saving by employing electrical transmission in such a case as we have assumed amounts to from $15,000 to $30,000 per year. And this figure could often be exceeded under the conditions actually existing in paper-mill work.

Another interesting branch of our inquiry is the advantage to be gained by distributing power to the various parts of the mill by motors, instead of by the usual long lines of shafting. Whatever the motive power, it is quite usual to drive the coarse machinery, grinders, beating engines, etc., where these are used, independently of the paper machinery proper, which requires a very uniform speed to get the best results. When hydraulic power can be used directly in so simple a drive as is usual in paper mills, there is no object in using motors. If the plant is steam driven, the advantage gained by concentrating the power plant will very seldom be enough to compensate for the losses incurred in electrical driving. In many manufacturing industries, where power has to be considerably subdivided and distributed over a considerable area, the losses of power in shafting and belts are so considerable, often 50 per cent. or more, that electrical driving becomes highly advantageous. When these losses fall to 25 per cent. or so the margin of economy in favor of electrical working becomes very small, and I am inclined to think that even in the big Fourdrinier machines, something like 50 yards in length, the avoidable losses in shafting are little, if any, larger than the figures just mentioned. If by electrical driving one could avoid all the shafting and gearing losses, and drive the working parts of the machine with some directness, the case might be different. But the parts of a Fourdrinier machine are so inter-related that really independent driving is practically out of the question. In the first place, the surface speed must be variable over a wide range, to accommodate various kinds and grades of paper, and the speed must be very steady, independent of load, to avoid trouble if the sheet breaks—not a rare occurrence. These requirements can be successfully met with motors, but in addition to these each part of the machine—wires, press rolls, dryer rolls, calenders, and reels—generally requires a slightly different speed, to take up stretching of the sheet under pressure and drying. Further, while for any one kind of stock the ratios of these speeds to each other are constant, they vary for each new kind of stock to a small, but very important, degree. And these ratios must be preserved at any particular time with an exactness which can hardly be paralleled in the industrial arts.

For instance, the surface speeds of two consecutive press rolls must be made to vary by, perhaps, a fifth of 1 per cent., and once established, this speed ratio must remain literally constant so long as the rolls are running. I do not think it is feasible to secure exactness in these minute variations by any method of motor regulation yet devised. It would be hard to imagine anything better adapted for the purpose than the cone pulleys now used.

Hence in the event of driving a paper mill by electrically transmitted power, the motive power cannot be advantageously subdivided into very small units. It is practicable, however, to save some waste power by abolishing all long shafts and working every part of the apparatus by comparatively simple drives. Thus, in an ordinary news paper mill, one could with advantage work by separate motors the wood preparing machinery with its conveyors, the grinders and the beating engines. Then, in the Fourdrinier machine it might be worth while to split up the power somewhat to avoid long lines of shafting, without dispensing with existing methods of varying the speed of the parts. For instance, all of the machine up to the press rolls could well be driven by a single motor, the press rolls by another, the dryers by a third, the calenders by still another, and the reels by a fifth. In driving a whole plant electrically some such subdivision could undoubtedly be made to economize power enough to be worth the while, perhaps to the amount of 10 per cent., which is worth saving even when power is cheap. But anything like a minute subdivision of power would be both inconvenient and unprofitable, and I do not think the saving is enough to justify the use of an electrical system for distributing the power except in connection with a transmission plant. It is quite as important to know when to let well enough alone as to have a prophetic instinct for improvements.

The question of electric heat for the drying rolls, and generally for freeing the pulp from water, has been several times broached to me recently. It is only fair to say right now to those interested that the amount of power required to furnish heat for drying the daily product of a modern paper mill is enough to stagger the wildest eyed and longest-haired electrical crank who ever claimed that electricity was in its infancy. That drying by steam is expensive is painfully evident to anyone in the business, but if you are minded to seek for improvements do not take up electrical heating until you have exhausted the possibilities of producer gas.

To sum up, the best field for the use of electric motors in paper manufacture is in reducing the cost of power, by utilizing the now well-tried methods of power transmission. By this means a mill can be located so as to obtain its material and ship its product economically, without foregoing the advantages of cheap water-power. With the transmitted energy at hand, power can be economized by the skillful use of motors in its distribution. There is no cut and dried rule or formula by which the best equipment can be at once determined. Each case has to be considered on its merits, and by the light of common sense, for in the last resort the best equipment is the one which enables you to turn out a given grade of paper at the lowest price.

Combinations of Capital in Relation to National Prosperity.

BY PROF. FRANKLIN H. GIDDINGS.

The subject of the trust or industrial combination is much too large to be discussed in an all-around way, in a single brief paper. The trust presents problems of the most important character to the business man, to the lawyer, to the statesman, and to the political economist. In what I have to say in the present paper I shall speak from the standpoint of the student of economic theory, leaving to others more competent than I the consideration of the relations which the trust bears to all matters of political and legal expediency. Moreover, I shall speak neither as an advocate nor as an opponent of the trust on grounds of economic expediency, but solely as an observer, who is interested to see what the trust does in fact do and what in fact it does not do, as an influence acting upon the production, the consumption, and the prices of goods.

I make two assumptions at the outset. The first is that the trust as a form of business organization could never have become the great factor in the commercial world that it is to-day, and could never have taken the hold upon the minds of business men that it has taken, if it had not been an efficient device for dealing with existing industrial conditions. Combinations of human forces are soon disorganized unless they produce results which justify them. It is idle to say that the trust is an incubus upon the commercial world so long as it grows and multiplies as it has done in recent years.

My second assumption is that intelligent and educated men do not really believe the often repeated saying that a rule or policy may be sound in theory, but bad in practice. There is no conflict between practice and sound theory. Any theory that is not confirmed and fortified by practice is false theory, and should be discarded as such. If a bridge which has been constructed in accordance with a certain engineering theory gives way under the strain that its builders have expected it to endure, civil engineers do not say that the theory is good as theory, but is bad in practice. They say that the theory itself is false. Both business men and economists should regard economic theory in the same way. If experience demonstrates that economic theories which have been taught in the text books and in the lecture room are not confirmed by business practice, the only conclusion that the clear-headed thinker can draw is that the theories themselves are inadequate or erroneous. I make no further apology, therefore, for assuming that both the business man and the economist have a real interest in discovering a true and adequate theory of the relation of the trust to expansions and contractions of production, and to the course of market prices.

The general public undoubtedly believes that trusts are able to make consumers pay more for all goods which trusts control than would be paid under conditions of unlimited competition. The economist should be able to say whether this prevalent belief is a great truth or a great delusion. Let us, then, look for a moment at the principles involved, and try to decide whether it is possible to state the economic law of price in a modern way—by which I mean a way which takes account of modern as distinguished from old-fashioned and outgrown business methods.

Imagine a commercial world in which the output of every important product is controlled by a single organization. Imagine that the entire wheat crop is commercially controlled by one trust, the cotton crop by another, the iron and steel output by another, the paper output by yet another, and so on through the entire list of marketable goods. In such a commercial world, so organized, would each of these great trusts be able to fix prices in accordance with its own desire to amass wealth and pay dividends, irrespective of the wishes and efforts of consumers? The prevailing opinion among consumers is, I think, that just such a thing would happen; and therefore the consumer finds himself regarding the trust as a gigantic power for extortion.

The truth, on the contrary, is that by no conceivable possibility could any such thing happen; and to make the point perfectly clear I will ask you to try to follow me in a demonstration which, in its reasoning, is essentially mathematical, but is not especially difficult. Obviously, if every product were controlled by a single trust, the situation would be precisely the same, so far as prices were concerned, that it would be if each product were controlled by a single individual. Let us, then, designate each product by a single small letter, a, b, c, d, e, etc., and designate the commercial control of each product by a single capital letter, A, B, C, D, E, etc. The commercial world, then, is made up of the individuals A, B, C, D, E, each of whom is the producer of some great marketable commodity, and each of whom is the consumer of the commodities controlled by his fellow producers. Now it may seem that A, who, we will suppose, is the producer and controller of wheat, can compel B, C, D, and E to pay extortionate prices for every bushel they demand, because, since no one else in the world can supply wheat, they must buy of A or starve; and that, in like manner, B, C and D, the producers of cotton, steel and paper, can charge extortionate prices because they command the only known supply. This, as I have already said, is the assumption which the general public makes. It is, however, an assumption which has all the characteristics of an inadequate and therefore a false economic theory. It would be true only on one condition, namely, that the consumption of goods was strictly limited to those small quantities that are absolutely necessary to support existence. Actually, however, that condition practically never exists in the real world. Human wants are indefinitely expansive, and every known commodity can be applied to a great number of different uses besides the primary one of supporting life. Wheat, for example, is used not only as a food product, but in enormous quantities it is converted into starch, dyestuffs, and other chemical products. Cotton is used not only for necessary clothing, but in vastly greater quantities for purposes of comfort, convenience and ornamentation. Paper is used not merely for absolutely necessary records, accounts, and communications, but in enormously greater quantities for pleasure, and even for trifling satisfactions.

While, therefore, an individual who absolutely controlled the supply of any given commodity might conceivably compel his fellow men to pay extortionate prices for that very small percentage of his product which was absolutely indispensable to their existence, by no possibility could he compel them to pay such prices for that vastly greater percentage which they desired merely for purposes of convenience, comfort and pleasure. This percentage they would buy or not, according as they thought that they could or could not afford it at the price which was demanded.

Nor is this all. Our comforts and pleasures are extremely variable things. Very few of us feel in any degree bound to choose one form of merely convenient or pleasurable satisfaction rather than another. We have preferences, of course, but we subject our preferences, after all, to a pretty rigid economic control. If, for example, I think that I would like a new set of china for my dinner table, but discover that the price is much higher than I had expected to have to pay; while, at the same time, I discover that some other article of household decoration, which I had believed to be quite beyond my means, is offered at a surprisingly low price, the chances are that I shall postpone my indulgence in china and purchase the alternative satisfaction. Now this principle, as everybody knows, is practically a universal law of human nature; and a law of human nature is an economic law which the producers and sellers of goods are compelled, in the long run, to obey.

What, then, would be the actual situation in which our imaginary producers, A, B, C, D and E, each having absolute control of a particular product, would find themselves placed in? They could if they chose limit production to those very small quantities of commodity which men must have or die; but if they did this, A, B, C, D and E would themselves live and die poor men. No great fortune would ever be amassed by that policy. The alternative confronting them, then, would be to encourage the development of a multiplicity of uses for their respective products, and a liberal consumption, to be met by a large production; and this they could do only by offering their goods at reasonable prices.

This alternative adopted, our imaginary producer would instantly make a most interesting discovery; the discovery, namely, that he was living and producing in a world ruled by competition, and not, as he had supposed, by monopoly. Until now he had imagined that the only kind of competition which he had to fear was a competition between himself and some other producer of the same sort of commodity which he was producing and offering. That is to say, A had thought of competition as coming only from some other A, A′, A″, etc. B, in like manner, had thought of competition as coming only from some other B, B′, B″, etc.; and he had supposed that in getting rid of such competition he had suppressed competition for good and all. Now he discovers that the real competition of the real business world is not the competition between A and A′, or between B and B′; it is the competition between A and B, between A and C, between B and C, between C and D, and so on. In other words, it is not the competition between one seller of wheat and another seller of wheat, between one manufacturer of cotton and another manufacturer of cotton, that really rules the business world; it is rather the competition between the producer of wheat and the producer of cotton, the producer of cotton and the producer of iron, the producer of iron and the producer of paper, and so on, which really controls the course of prices. This competition is real, it is inevitable, it is controlling, because of the ineradicable fact that each of these producers is appealing to a consuming public whose purchasing power is limited. The consuming public is not at present, and so far as human foresight can now perceive it will never be, in the enjoyment of an unlimited income. Consequently, if the world buys more wheat, more cotton, and more iron, it will, sooner or later, and for a limited time, buy less paper, less china, less furniture, and other things. Every industry, then, is appealing to a consuming public to which every other industry is appealing, and which cannot buy unlimited quantities of commodity from each industry. This simply means that when one group of producers demands unusually high prices, all other groups of producers can very considerably increase their sales in virtue of that law of human nature according to which men can and do, to a great extent, substitute one group of conveniences and pleasures for another, postpone certain enjoyments for a time, and distribute their expenditures at all times in such a way as to obtain the greatest satisfaction for a given outlay.

Dropping now this figure of an imaginary world in which each product is absolutely controlled by a single producer, we observe in the actual business world of today a certain approximation to the condition of things which has been described. Nearly every important industry is now controlled by a trust or a business organization closely resembling a trust. This means that to a considerable extent the competition of A with A, of B with B, and of C with C, has been brought under control. It does not mean, and it cannot mean, that the competition of A with B, and of A with C, and so on through the entire list, has been suppressed. It still remains true that the great bulk of commodities is produced to satisfy the demands of comfort and convenience, and not to satisfy those of absolute necessity. It still remains true that consumers can and will curtail any particular group of comforts and conveniences when their prices rise beyond a certain limit, and expand the enjoyment of other comforts and conveniences if their prices are lower. It still remains true, in short, that producers organized into trusts, quite as much as producers who compete with one another, are offering their commodities to a consuming public whose annual income is a limited amount of purchasing power, a public which therefore distributes its commercial favors unequally among all these different trusts, and therefore compels the trusts to compete with one another, however perfectly each trust may have suppressed competition among its own producing members.

There need be no fear, then, I take it, that the consuming public is to be brought under economic subjection by the trust. Competition disappears in one form only to reappear in other forms. Economic law is as inexorable as the law of gravitation; and business will never cease to be controlled by it.

The trust, like any other form of human organization, may do evil as well as good, but it is not now my purpose to discuss the trust in its moral aspects. Much harm, I think, has been done already by confusing the moral, legal, and political conduct of trusts with their economic function. No sensible man would think of condemning a business career as immoral, as illegal, or as contrary to public policy just because business men have been known to cheat their customers, to defraud their creditors, and to bribe officials. Is it any less irrational to denounce the trust as an unrighteous invention because trusts have been known to do things which the moral consciousness of mankind condemns, and which good citizenship pronounces contrary to public policy? The trust should be dispassionately regarded, and calmly studied as a form of organization which is powerful for both good and evil, and it should then be held by the public to the same moral responsibility to do good rather than evil which the common conscience of mankind imposes upon the individual. My effort in this paper has been to show that if the trust conducts its affairs within the limits of morality, law, and public policy, it can never inflict ruin on the community in consequence of its strictly economic functions.

The annual report of the Knickerbocker Press, New Rochelle, N. Y., shows capital stock of $150,000, all paid in; debts do not exceed $38,000, and the assets are $180,000.

The George H. Richmond & Son Book Company, New York, has been incorporated. Capital stock, $12,000. Directors, George H. Richmond, George H. Richmond, Jr., and L. I. Haher.

AMERICAN PAPER AND PULP ASSOCIATION.

(*Continued from page 147.*)

W. T. Barker—I think that is a very good suggestion, and I will go a step further, and refer the matter back to this committee, with instructions to formulate a definite plan of procedure, which can then be put in form and sent out by our secretary, not only to the various members of the association, but to all manufacturers, with the request for their assent or dissent, whether they will or will not become parties to such a plan. Then, if the replies are favorable, we will have something definite to bring before the association at another time.

The President—As I understand the last suggestion, it amounts to this: It is moved and seconded that this question of preparing statistics of the production and sale of paper receive the indorsement of the association, and be referred back to that committee, and the committee within sixty days shall report to the executive council, and the action of the whole become that of the association.

The motion was put and carried unanimously.

TRADE HEADQUARTERS.

The President—The next matter to report upon is the establishment of a headquarters.

Colonel Paine—The chairman of the committee, Thomas Duncan, is absent. He has not attended our meetings, and I think he is ill. He has not called his committee together, although many of us who have been interested in this question lately have thought it a very important subject. In his absence I will read a communication from the secretary to the committee on headquarters, which I think embodies our view. I can make no further report because there has been no committee meeting.

NEW YORK, February 16 1898.

To the Committee on Headquarters:

Gentlemen—You are no doubt aware in general of what steps have been taken toward carrying out the project of establishing headquarters in this city for this organization. The idea originated with, or at least the first definite purpose to carry it out was expressed by, Mr. Chisholm, our president; heartily concurred in by the executive council, and endorsed by a large majority of those whose opinion was sought. At an informal meeting in this hotel several months ago the committee to take the matter in hand was nominated and appointed, consisting of some twenty-five of the representative men of the industry. Almost without exception these gentlemen upon being communicated with approved the project. Suffice it to say that the lines on which we have been working were to raise a guarantee fund, or rather, to secure the financial endorsement of the project by 100 persons, and at the same time endeavor to find suitable quarters, so as to go before the members of the trade with something definite. With comparatively no effort at all thirty-five names were secured to the guarantee fund agreement, a copy of which I hand you herewith, and two others have signified their intention of signing. I hand you as well a list of the subscribers. Here the matter was allowed to rest, for the reason that a location combining just the features deemed advisable did not seem to be immediately available. There are, however, prospects of such locations being obtainable within the present year. We had hoped to come to this meeting with a definite proposition from the agents of one or more buildings, but found it impossible.

In general, the prevailing opinion seems to be in favor of securing, say, 2,000 square feet of space in some downtown office building, in or near the paper centre, in such proximity to a first-class restaurant that by dumb waiter or other communication restaurant service could be extended to the association rooms, thus securing the drawing qualities of a restaurant without the expense; and further, that the rooms should be so attractive as to make them an acceptable rendezvous for the paper trade of New York city and visiting paper men. And further, that all the facilities for transacting business should be afforded, and that the association should have a salaried secretary constantly in attendance.

From conversations I have had, and communications that I have received, I believe that such headquarters could and would become a nucleus about which would cluster various other allied interests.

I hand you herewith also a rough estimate of the persons available for membership, should the project take the form of a club. I also hand you a rough financial estimate, drawn up as a basis of discussion at one of the committee's meetings.

I believe that the executive council would favor the appointment of a permanent committee to carry on the project if it receives the endorsement of your committee and the association. Yours truly,

C. W. LYMAN.

The President—Please give us your individual opinion.

Mr. Paine—While our organization is not large enough to establish a club on the lines of the Hardware Club or the Merchants' Club or the Lawyers' Downtown Club, yet we have a membership large enough for a nucleus, and I am sure it will tend to increase our membership. I have no doubt that it will double it within two or three years, if we have such a head-

quarters in New York, where all our friends can find telegraphic and telephonic facilities, and a permanent secretary whom we can address on any subjects connected with the trade—an assistant secretary he should be, with a salary. The expense would not be very large, and it seems to me we ought to try to make a beginning. I have no doubt at all, after our friends in the trade shall have digested fully the contents of the papers read here and the great advance this association has made since I became a member of it, but what we shall meet great encouragement, and all our friends will feel like helping. That is my feeling about it personally.

The President—I should like very much indeed to hear expressions from other members of the association in connection with a headquarters.

Colonel Haskell—I am very much interested in the proposition that has been made, because I think it is one of the most important matters that we have had before us. I think it has been a mistake on the part of the association not to establish headquarters. In various papers and by the recommendations that have been made in previous years by its officers, the desirability of establishing a headquarters for the association has been suggested. I feel confident that no step which this association could take would prove so valuable as the establishment of a permanent headquarters. Whether that should be done by the association, as I personally feel it should, or whether it should take the form of a club, with a certain number pledged to assume whatever deficit might accrue at the end of one or two years, in some way or other it seems to be very desirable that this step should be taken. There are so many lines of work in which this association ought to engage, which have been indicated from time to time, they come out continuously in our discussions. A great many matters which come up in the way of transportation, the question of the classification of freights, the question of credit; these could all be attended to if we had permanent headquarters and a permanent official; and in many other lines which will suggest themselves, I think, to all members, it is very desirable that a step of this kind should be taken. Just how it should be taken I myself am in doubt. I think there is a feeling that it should be done, and that it should be undertaken by the association, and it seems as if by an inquiry sent to every manufacturer and every member of the association, asking them to become members, and fixing a definite charge per year you would be able to cover that; and not, perhaps, undertake it along the line of having a guarantee from a few members, upon whom the burden must come if the matter should fail.

D. S. Cowles—It seems to me that in the matter of establishing a headquarters, while it is perhaps a good one to consider, it would be a mistake to have the consideration of it turned in the direction of a social club. In the first place I do not believe there is a large enough membership in the paper trade to make a social club, or a club in the ordinary sense, a success here in the city of New York. A club here is a pretty expensive affair.

The President—I do not think it is the intention that this is to be a club. It is simply a question of a meeting place down town where, if you happen to be in at 1 o'clock, if you could get a dumbwaiter connection with a restaurant you could take lunch there instead of going into restaurants. In no sense a club, only a headquarters; a place to meet and to have communications sent to.

Mr. Cowles—However, the principal discussion has all tended in that direction. I would like to make a suggestion. I understand that many of the trades—I think that the leather trade in New York, and I think in the woolen trade, in some branches of the cotton industry, and in other similar trades they have a bureau of information. They have a paid secretary and officers and clerks whose entire duty it is to collect information with relation to the trade, which can be had on application by the members. It does not seem to me that our trade particularly needs a meeting place, but something within this present organization might be established and carried out which would give every member of the association all the advantages in that line that are needed. My idea would be that to keep it strictly within this association would be better than to have one outside of the association; but to make it a species of statistical bureau, where anybody who wanted information in relation to the paper trade, of any kind or description, could obtain the same on application.

The President—There is the freedom that one would have in the headquarters. One would be under no obligations to any special jobber, or anybody else in the city, if he enters a room, reads his paper, has his mail forwarded there, and makes appointments to meet friends there. I certainly look upon it from an entirely different standpoint. I think if there is any one thing that would accomplish a good result and bring about an increased permanent membership to the association it is the offering of inducements here in New York, at a small cost, of advantages that such a well-regulated headquarters as that would afford. And I must say that I am heartily in accord with anything that will lead up to what will be the best way to do it. I realize also the necessity, and not only the necessity but the duty, of any man proposing this new departure in the way of establishing an institution to recognize that the first thing in order is in no way to endanger the present organization, nor to enact anything that a reasonable percentage of the present membership could take any exception to. They have belonged here for twenty years, more or less, and they have remained by the organization under its present general policy. It is very essential that we do nothing that will give them cause to withdraw, but do what we can to bring a larger percentage of people into the organization, who are not members at the present time. We have about 1,200—maybe 1,000 to 1,100—pulp and paper mills in the United States. Our membership at the present time is a little over 250. We ought to have, legitimately, from our own direct industry, at least 600 members.

Now, how best to bring about that result and to give something in return for the assessment which we charge for becoming members is a problem that we have to settle in an intelligent manner. It is not the people here in the city of New York, excepting as far as the trade goes. The great mass of the manufacturers live out of New York; and the question is how best to interest and amuse and offer advantages to those people when they come, whether it is once a year, twice a year, three times a year or oftener. Why, if the assessment is made low enough there is a possibility, I think, that you could increase your membership from the advantages given in that direction very perceptibly. I should be pleased to hear any other remarks in regard to the matter.

Colonel Haskell—I rise to move that this committee on permanent headquarters be continued, for the purpose of further considering the matter and reaching some conclusion, either in the direction in which I suggested of sending out to the various members of the association inquiries to ascertain whether the establishment of headquarters would meet their approval to the extent of the added dues which might be proposed, or to take up any line of investigation pending the next meeting of the association or any special meeting which may be called for that purpose.

Colonel Paine—Considerable progress ought to be made in the direction of bringing about this result. There has been a great deal of work done, and the president, who has done so much for us this year, I know is especially desirous that we continue this work, and bring about something of this sort as soon as possible. I might say that we were notified only to-day that that new and magnificent building on Park Row, directly opposite the Astor House, is going to have a restaurant on the same plan as the Savarin on the top floor; the people there are willing to give us the next floor below at a very moderate rent on a three years' lease for a club of this kind, and we can have connection with the restaurant, and go there and buy our things as we want them. I hope the matter will not be postponed for another year. I hope the gentleman will modify his resolution, so as to continue this work and report to the executive council earlier.

Colonel Haskell moved as a substitute for the original motion, that the matter of the establishment of a headquarters be referred back to the committee, with instructions to report to the executive council, the said report to be made within sixty days, the action of the council to become the action of this association.

The motion was carried unanimously.

The Paris Exposition.

Colonel Haskell read the report of the committee on the Paris exposition, as follows:

Your committee to whom was referred the matter of the representation of the paper and pulp industry represented by this association at the approaching Paris Exposition of 1900 have attended to their duty, and respectfully beg leave to report.

It must be clear to all who have given this important matter any consideration, that the opportunity which will be afforded, through an exposition of the arts, sciences and industries of the world of the character proposed, for the paper and fibre industries of our countries to demonstrate their ability to produce not only as good a quality of paper and fibre, but in many lines unquestionably to excel other countries in these products, has never before been offered on so extensive a scale. It has come to be recognized as a well-known fact that the paper and fibre makers of our country are fast overtaking and passing many of the older established paper producing centres of England and the Continent, not only in the superior character of our chemical fibre and pulp, as shown in its working qualities, but also in the many lines of products of paper from the various grades of fibre which we produce.

And the genius of this, our most progressive industry, so well equipped in every direction, added to our superior natural advantages in many directions, makes it clear that in the near future the products of the paper and fibre plants of America will not only be distributed, but thoroughly appreciated, in a sense which does not now prevail, in all the leading countries in the world. That this is felt and recognized by our leading manufacturers is shown by the special efforts made during the past few years to extend the knowledge of the excellence of our products, through the extension of our trade with foreign countries, and which has resulted during the year just closed in an increase of nearly 100 per cent. in value of the exports of the products of our mills over the year preceeding.

It is therefore manifest to your committee, and we feel that it will appeal to every member of this association, that the opportunity which will thus be afforded us to unite in presenting to the consumers of the world an exhibit of the products of our mills, with a view to an increased development of our trade with foreign countries, is one which should be welcomed with enthusiasm, and entered upon with a desire and purpose to emphasize to all other countries our position as leading producers of paper and fibre of a superior character, and which will be in keeping with the industrial development and the material resources of our country along other lines of effort.

Your committee are advised that it is the desire and purpose of the board of management at the Paris Exposition, so far as possible and practicable, to arrange for the presentation of collective exhibits of the various industries, to include in one comprehensive group the raw materials the various products in the course of manufacture, and as elaborate a display as possible of the finished product. If this can be done in connection with our own display, through the co-operation of our paper machinery manufacturers, by the installing of machinery of the highest and most advanced type, it will certainly not only add greatly to the attractiveness of our exhibit and contribute to the educational feature which the management have in view, but will also, in our judgment, materially benefit our combined industry along the lines which we have in view.

We therefore recommend that a permanent committee be appointed in such a way as the association may deem best, to arrange at as early a date as practicable the details of a plan for the representation of the paper and pulp products of America at the Paris Exposition of 1900, that this committee be authorized to apply at once for suitable space, and that this committee either be given full powers, or instructed to report at a special meeting of this association, to be called during the coming summer months.

The report was unanimously adopted.

On motion the present committee was made a permanent committee on the Paris exposition.

Election of Officers.

The president called for the report of the committee on nominations.

Colonel Paine—We have a unanimous report, without much discussion, which will be very gratifying to you, I think, as it recognizes the eminent services of the officers of this association. We present to you the following names:

For president:

Hugh J. Chisholm. (Applause.)

For vice-presidents:

Writing Division—William F. Whiting.
Book Division—James N. Mohr.
News Division—George C. Sherman.
Wrapping Division—Samuel P. Train.
Wood Pulp Division—K. B. Fullerton.
Chemical Fibre Division—A. G. Paine, Jr.
Board Division—Charles D. Brown.
Secretary and Treasurer—Chester W. Lyman. (Applause.)

Delegates to National Board of Trade:

William T. Barker.
William H. Sharp.

On motion the secretary was authorized to cast one ballot for the list of officers reported by the nominating committee.

The secretary cast the ballot, and the gentlemen whose names were presented by the nominating committee were declared elected.

Colonel Paine—Before we adjourn I wish to propose a vote of thanks to the president, and secretary and treasurer, of the association. I think the success of the meeting of the last two days as the result of the labor done in the last year entitles them to a vote of thanks.

The motion was seconded, and, being put by Colonel Paine, was carried unanimously.

J. N. Mohr moved that the association extend to The Paper Trade Journal a vote of thanks for its kind offer to prepare and gather statistics, and the motion was unanimously adopted.

The association then adjourned.

THE BANQUET.

On Thursday evening the annual banquet of the association was held in the Astor Gallery of the Waldorf-Astoria, and was very largely attended, extra tables being added to accommodate the diners.

President Chisholm presided, being flanked on the right by Hon. Joseph W. Symonds, Hon. Warner Miller, D. O. Mills, Prof. Bernhard E. Fernow, Hon. Wellington Smith, Prof. Louis Bell and Charles F. Scott and on the left by Charles W. Knapp, Col. A. G. Paine, William H. McElroy, Hon. William Whiting, Rev. Minot J. Savage, E. C. Rogers, Clemens Herschel, Col. Louis Hamburger, William Cullen Bryant, Gifford Pinchot and Secretary C. W. Lyman.

Among those at the other tables were: C. H. Southworth, George E. Bardeen, Charles H. Dobilinski, Austin M. Purvis, Charles Wilson, W. W. Page, C. W. Knode, M. S. Flint, S. C. Knode, W. F. Daniel, E. T. Newton, Wm. D. Judd, Philip A. Bour, C. H. Wickham, Martin A. Metzner, George P. Tangeman, R. F. McElwain, C. A. Crocker, Edward P. Butts, Thomas L. Jones, B. D. Rising, O. A. Miller, H. A. Moses, Charles L. Toomey, Robert B. Atterbury, Hazard Lasher, William E. Conrow, D. G. Garrabrant, W. D. Russell, Jonathan Bulkley, Arthur W. Eaton, W. W. D. Jeffers, John Lambert, William I. Higgins, James Pirnie, A. S. Demarest, C. O. Woods, Wallace Jeffers, George B. Bascom, T. S. Coolidge, G. C. Andrew, W. T. Etherington, William T. Barker, George B. Hanford, R. G. Hanford, Theodore Conrow, Spencer Lathrop, R. W. Smith, George W. Wheelwright, S. W. Marvin, W. N. Chapin, T. S. Coolidge, George B. Bascom, A. E. Osborn, F. W. Wilson, C. A. Clarkson, N. R. Hopkins, Samuel Gannete, F. C. Bishop, A. L. Hollingsworth, C. W. Rantoul, Jr., C. E. Bush, Dr. C. S. Merrill, F. T. Ray, M. B. Klopp, J. W. Towne, Charles D. Brown, Homer Locke, John C. Duncan, William H. Parsons, Jr., B. F. Reist, H. W. Wyman, Charles S. Barton, N. T. Pulsifer, A. Salomon, George W. Russell, James B. Forsyth, W. F. Kellogg, Hugh Cochran, A. T. Dennison, David S. Cowles, T. C. Whitehouse, Charles P. Cowles, John W. Flint, Hugh Blethen, A. L. Delesdernier, L. Massen, J. S. Crowell, Charles D. Mead, Harry T. Bartow, N. M. Jones, Col. S. P. Train, Robert D. Carter, D. A. Loomis, George B. Wergman, K. B. Fullerton, Charles M. Palmer, Henry M. Knowles, John H. Duffy, J. B. Paddock, B. M. Jackson, George Crocker, A. N. Burbank, Col. Charles Elverson, Jr., William B. Dillon, C. M. Fairbanks, George H. Parks, Isaac B. Hosford, C. Louis Duval, J. Fred. Webster, William E. Speir, J. Ambrose Butler, M. W. Phillips, F. H. Hatzel, Frederick H. Parks, John E. Norris, F. L. Montague, L. Alers-Hankey, Alexander W. Orr, E. G. Mosher, O. E. Hungerford, Richard D. Knight, Daniel A. Bullard, 2nd, H. K. W. Welch, Edward P. Nixon, Don C. Seitz, Frank Squier, J. Howard Friend, C. K. Urquhart, W. H. Ukers, Frederick Bertuch, G. A. Edler, E. S. Daniel, Alvah Miller, George C. Sherman, Thomas T. Waller, Frederick Vilmar, W. D. Woodruff, H. Powell, Ramsdell, William H. Nixon, Maj. J. Fred. Ackerman, William H. Savery, Willard Saulsbury, Hon. Arthur C. Hastings, O. B. Hastings, Jean Freese, Elmer Dixon, W. E. Capen, Martin Cantine, T. B. Morrell, R. George Buchanan, Edwin Riley, Robert D. Ingram, L. M. Bickford, Thomas H. Savery, Leighton Lee, William W. Pusey, Preston Lea, J. W. Delaney, Edward Conley, James Conley, F. W. Felch, R. C. Harris, Joseph G. Marriner, Capt. Horatio Hall, Allen M. Fletcher, Henry B. Platt, P. G. Bartlett, C. C. Woolworth, Mr. Graham, J. F. Anderson, Jr., Charles A. Brown, Robert Cambridge, Charles McDowell, D. W. Patton, George N. Megargee, Thomas S. Safford, C. C. Walden, Charles M. Stoever, W. R. Sheffield, William F. Greiner, George R. Vernon, James N. Mohr, J. S. Frazee, Samuel H. Egolf, E. L. Embree, Sydney F. Walker, D. W. Evans, Charles L. Hamilton, William H. Sharp, Hon. George West, Clarence Beebee, M. R. Kennedy, W. H. Miller, George A. Gardner, J. E. Bachelder, David Luke, Adam K. Luke, F. S. Arnold, John H. Danby, John G. Luke, Col. W. L. Brown, Charles Beebe, Mr. Bangs, E. C. Spear, William Hilliman, A. E. Waugh, Alfred Rindskopf, Augustus G. Paine, Jr., M. B. Sloat, H. F. Harrison, William Luke, S. Goldman, Arthur W. Clapp, W. W. Brown, H. J. Brown, E. F. Birmingham, G. I. Herbert, De Peter T. Austen, James Z. Pruyn, A. H. Nevins, J. H. Murphy, F. A. Flinn, Geo. W. Knowlton, Frank Gilbert, C. H. De Lano, E. H. Clapp, Charles N. Sherman, J. W. Booth, Edward M. Adams, Arthur W. Pope, Col. John T. Collins, Samuel N. Byers, John R. Bartlett, James W. Murphy, Col. Edward H. Haskell, James J. Breslin, George Nightingale, F. W. Herring, H. P. Browning, F. P. Browning, W. D. Woodruff, F. J. Marshall, E. S. Marshall, H. C. Berlin, H. E. Pratt, Mr. Jenkins, W. A. Underhill, Albert Salomon, Wilhelm Salomon, Percy Herrick, Col. J. C. Morgan, Hiram Allen, Warren Curtis, S. S. Stevens and A. N. Mayo.

The sherbet was served in imitation wasps' nests, the wasp being recognized as the original paper maker. The menu cards were printed in gold, the monogram of the association being embossed in gold on a pegamoided paper cover.

The post prandial exercises were begun by President Chisholm, who spoke as follows:

Members of the American Paper and Pulp Association, and friends—As presiding officer, I extend to you all a most hearty welcome, and to you gentlemen who have prepared with such great ability the different articles which have been read at our business meeting I extend the thanks of our organization for the services you have rendered. (Applause.) I congratulate the association upon having present to-night so many of our ex-presidents, and the only occasion for regret is the absence of four of their number. I fully understand that to make an occasion of this kind a success there are two essential things to attend to. First, the body; second, the mind. You now know well what your officers have done in providing for the former; it remains to be seen how well they have arranged to entertain the latter. For my own part, I believe the best is still in store, for we have to hear those who are not only eminent in their various walks of life, but gentlemen who are able to respond to their allotted toasts in a manner that will justify my belief.

Our first toast is "The American Newspaper," which will be responded to by one who represents one of the oldest newspapers in the country, if not the oldest, and one of the oldest families connected with newspaper publishing. What knowledge of publishing he has not inherited he has acquired. I now call upon Charles W. Knapp, president of the American Newspaper Publishers' Association. (Applause.)

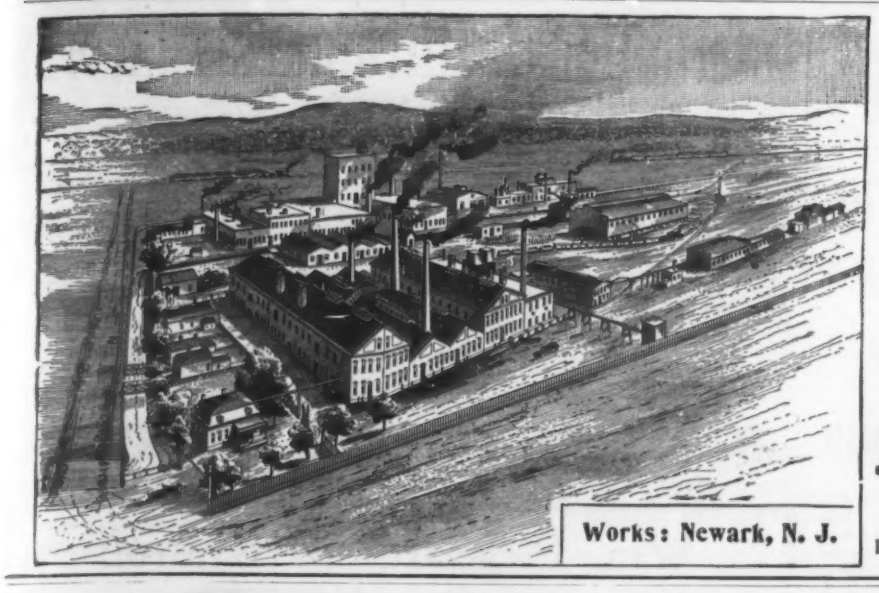
Response of Charles W. Knapp.

Mr. President and Gentlemen of the American Paper and Pulp Association—A producer of paper, surrounded by producers of paper, I feel myself in the house and in the hands of my friends. (Applause.) I bring to you as an accredited messenger a message of congratulation upon the auspicious occasion that has brought you here—a message of greeting, not alone from one paper, but from many papers. My credentials issue, as your worthy chairman has said, in an individual capacity from one journal which has been in continuous business relations with the paper trade for a period of ninety years, lacking but three months; and during that time the patronage, strengthened through long years from the ties of business to the broader ties of friendship, has become bonds, stronger than steel. Gazing into your uplifted faces there comes to me a realization of the serious burden I have assumed in undertaking to speak in such a gathering of paper manufacturers for the American newspaper. I look about me and I see a distinguished company of philanthropists. (Laughter.) I am surprised that you should not receive with the seriousness it merits the compliment you so fully deserve. Evidently you have not been accustomed to think of yourselves as philanthropists; yet if you will reflect a moment, for a period of quite a third of a century you have been pouring your munificent beneficence into the lap of the American publisher with a liberal and lavish generosity. It is not a straining of words to call it downright philanthropy. For fully thirty years, within my personal knowledge and within my personal experience, your gifts have grown richer and richer year after year. It is little wonder that the missionaries you have sent abroad over the land, as almoners, to dispense your cheap paper, have ever found a ready welcome at the publisher's door. I thank you for the opportunity you have given me to-night to give expression to my personal indebtedness, for I willingly admit that a large part of whatever business success I may have achieved is directly, if not entirely, due to cheap paper. (Laughter and applause.)

Yours is a great business, gentlemen. It was on my tongue to say it is a glorious business; and I might just as well say it, for it is certainly a glorious thing to have been the most influential, in fact the controlling, factor in one of the greatest developments of this century, a century most notable in all the ages for its marvelous progress. I tell you nothing new when I say that you have made the American newspaper of to-day a possibility. Directly from your business enterprise and liberality has come this wonderful product. Should you not be proud, for you share in that accomplishment? You have erected a monument more striking than sculptor's marble, and more enduring even than imperishable granite. (Applause.)

If you wish adequate appreciation of what this monument is, just consider what the American newspaper is. It is the complete embodiment of the best Americanism. Whatever is truly typical, representative, distinctly individual and characteristic, in the new people born to the world in this land of liberty and freedom, has full and fitting expression in its newspapers. This may not be the ordinary conception of the newspaper. I fancy that the common impression is that the newspaper is the product of a theoretical working out in the editor's mind of some standard set up before he begins his work. Nothing could be further from the fact. The successful

(Continued on page 170.)



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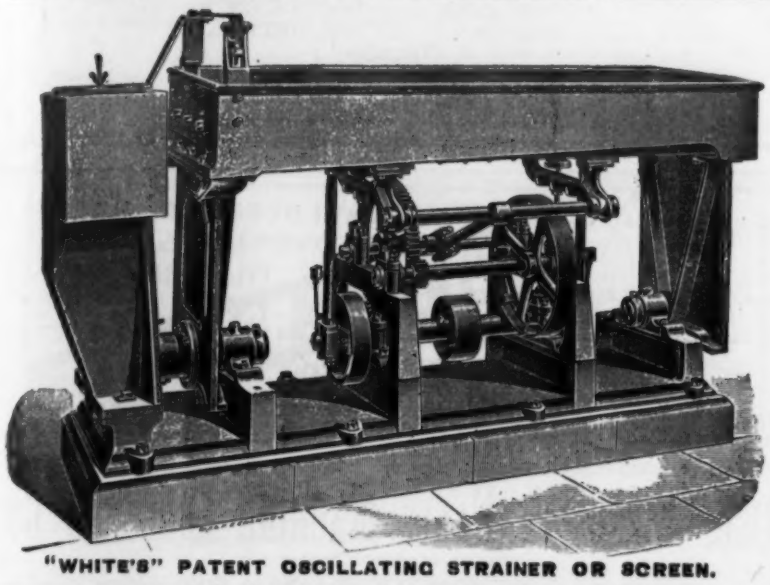

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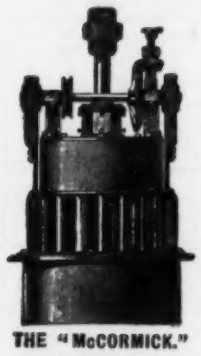

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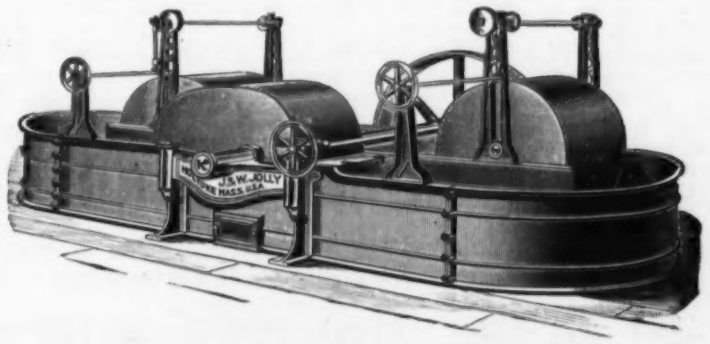

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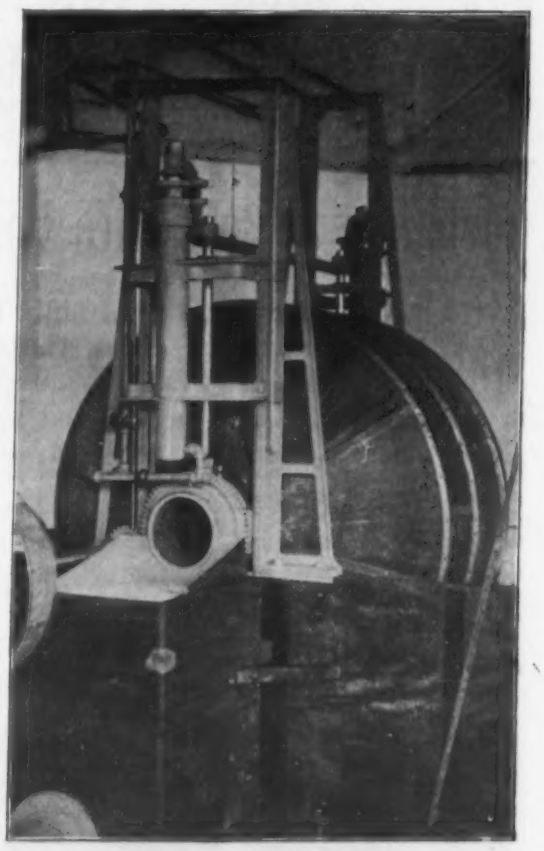

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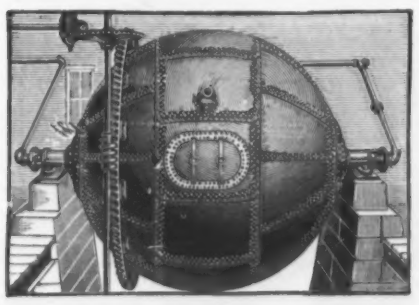

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CONTENTS.

INTRODUCTION.

General Laws of Chemistry; Principles of Chemical Physics; Chemical Arithmetic.

PART I.

General Chemistry—With a short account of each element and its principal compounds; source, manufacture and properties of such compounds as are used in paper making.

PART II.

CHAPTER I.—**Cellulose.** Its chemical and physical properties, chemical relations and reactions.

CHAPTER II.—**Fibres** Cellulose in its relations to the plant; the vegetable cell; the cell wall; changes which occur in the cell wall; lignin or incrusting matter; its chemical properties; characteristic markings of the cell wall in different fibres; characteristic cells other than fibres in different pulps. Classification of fibres: 1. Seed hairs; cotton, chemical and physical character of fibre, dimensions, analyses. 2. Bast fibres, as linen, jute, hemp, manilla, rhea, ramie, agave, sisal, adansonia, &c.; occurrence in plant, separation of filaments; character, size, distinguishing features of filaments and ultimate fibres, analyses and chemical properties. 3. Fibres and other cells from whole stems and leaves, as straw, esparto, bamboo; measurements and characteristics of fibres, yields, analyses; characteristic cells found with fibres. 4. Wood fibres; growth of wood; cambium layer; spring and autumn wood; sap and heart wood; resins; bark and knots; analyses of woods; specific gravities; ash; fuel values; occurrence and character of all woods used for pulp making.

CHAPTER III.—**Processes for Isolating Cellulose** Rag boiling; special treatments for various fibres, as jute, straw, esparto; review of miscellaneous processes for treating wood; the water process, aqua regia, &c.; the soda process, history; preparation of liquors, boiling, washing, recovery, sources of loss; analyses of chemicals and liquors; the sulphite process, history; general principles; the different systems; liquor apparatus; preparation and analyses of liquors; digesters; linings; boiling; subsequent treatment of pulp; waste liquors; recovery. The sulphide and sulphate processes.

CHAPTER IV.—**Bleaching.** General principles; bleaching agents; bleaching powder; deterioration; analyses; preparation of bleach liquors; use in chests, engines, drainers; hot bleaching; acid bleaching; use of alum; chlorination and oxidation of fibre; washing stock, antichlors; loss in bleaching; ozone bleach; hydrogen peroxide; permanganate; sulphurous acid; special processes for various fibres.

CHAPTER V.—**Sizing and Loading.** Rosin; preparation of size; free alkali; free rosin; alum; analyses of alums; free acid; basic alums; sizing power; resinate of alumina; moss; casein; wax; starch; animal sizing; preparation and use; drying; loading; analyses of clays, agalite, pearl hardening, &c.; use; retention; ash; combined water, effect of alum and starch.

CHAPTER VI.—**Coloring.** Mineral colors; vegetable and animal colors; aniline colors; chemical properties; effect of alum and traces of bleach or alkali in different colors; distinguishing tests, effect of different waters.

CHAPTER VII.—**Water and Water Supply.** Character and analyses of different waters; ground waters; surface waters; river water; artesian well water; hard and soft waters; boiler scale; effect of waters on size and colors; various systems of filtration; use of alum; softening water; self-purification of streams; natural filtration; effect of storage; vegetation in ponds; crenothrix; consumption of bleach by waters.

CHAPTER VIII.—**Chemical Analysis.** Description of apparatus and methods for testing the purity and strength of all paper making chemicals, colors, &c.; common impurities and adulterants given; full description of methods of analysis for sulphite and soda liquors, bleach, solution, alums, &c.

CHAPTER IX.—**Paper Testing.** Full account of the latest German methods for testing and classifying papers; determination of ash; kind of sizing; amount of sizing; free acid and chlorides; strength; proportion of ground wood; kind and condition of fibres.

CHAPTER X.—**Electro Chemistry,** with reference to bleaching, manufacturing of pulp, manufacturing of chlorine and soda.

APPENDIX.—Metric system; tables of specific gravities; strength of solutions; list of sulphite patents, &c.

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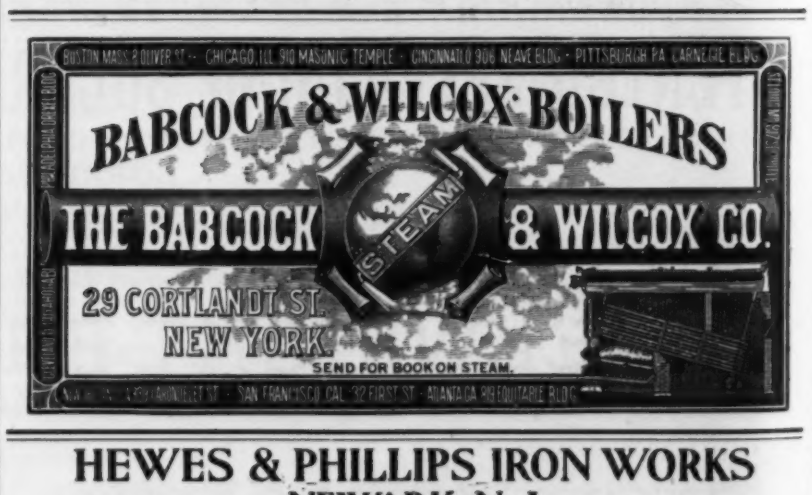
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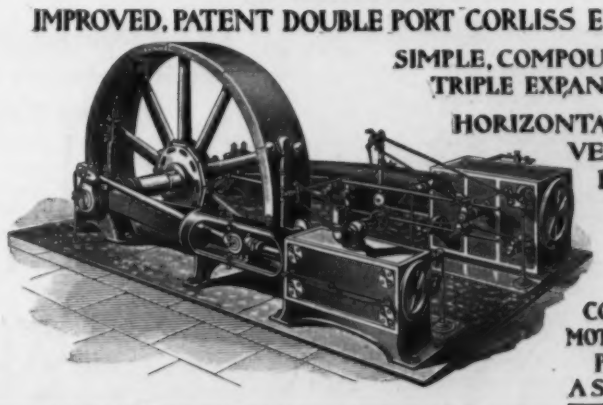

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IMPORTS AT NEW YORK.

FOR THE WEEK ENDED FEBRUARY 11, 1898.

Alum	3	$80
Aluminous Cake	....	....
Aniline Colors	857	52,367
Bleaching Powders	302	4,366
Books	376	38,552
Clay	....	1,072
Engravings	35	3,241
Jute butts, etc.	12,634	28,966
Newspapers	387	9,932
Paper	601	23,450
Paper Hangings	19	1,175
Paper stock	1,480	10,093
Printed Matter	228	25,761
Soda Ash	1,714	2,090
Soda Caustic	300	2,750
Soda Hypo	88	320
Soda Sal	280	600
Talc	....	....
Terra Alba	....	....
Ultramarine	10	480
Waste	93	4,519
Wood Pulp	210	1,240
Totals	19,617	$911,494
Imports General Merchandise for the week ended February 11, 1898		$6,297,900

IMPORTS OF PAPER STOCK AT NEW YORK.

FROM JANUARY 1 TO FEBRUARY 16, 1898.

Whence Imported.	Rags. Bs.	Old Papers. Bs.	Chemical Fibre. Tons.	Manilla Stock. Bs.	Coils.
Antwerp	1,640	....	30	2,122	....
Calcutta	....	....	....	272	....
Copenhagen	444	....	....	....	....
Dundee	....	....	....	178	....
Dunkirk	164	....	....	....	....
Genoa	596	....	....	682	....
Glasgow	43	326	....	....	....
Hamburg	1,043	....	....	453	....
Havre	42	....	....	432	130
Hioga	2,371	....	....	....	....
Hull	1,089	15	93	2,331	....
Kobe	2,150	....	....	....	....
Leghorn	900	....	....	....	....
Leith	....	....	....	801	....
Liverpool	96	73	....	141	128
London	479	592	....	958	....
Newcastle	....	....	....	186	....
Nova Scotia	....	....	260	....	....
Rotterdam	538	....	15	49	....
Stettin	47	....	10	98	....

NEW YORK IMPORTS.

FROM FEBRUARY 9 TO FEBRUARY 16, 1898.

Paper Stock.

A. Katzenstein & Co., Westernland, Antwerp, 296 bs. rags.
R. F. Downing & Co., by same, 30 ts. chemical fibre.
Jessup & Moore Paper Company, Oropa, Genoa, 539 bs. bagging.
Castle & Gottheil, by same, 143 bs. bagging.
J. Liebmann & Co., Anchoria, Glasgow, 43 bs. rags, 100 bs. old paper.
Jessup & Moore Paper Co., Arabia, Hamburg, 31 bs. rags.
Castle & Gottheil, by same, 152 bs. rags.
Lewy Brothers Company, by same, 112 bs. rags.
J. Joseph & Co., by same, 229 bs. cotton waste.
James Pirnie, Liverpool, Havre, 141 bs. bagging.
Train, Smith & Co., Hindoo, Hull, 222 bs. bagging.
H. Dutton & Co., Colorado, Hull, 382 bs. rope.
J. W. Mason & Co., by same, 225 bs. rope.
Castle & Gottheil, by same, 147 bs. rags.
F. Bertuch & Co., by same, 10 ts. chemical fibre.
James Pirnie, Bovic, Liverpool, 49 bs. old paper.
Castle & Gottheil, by same, 62 bs. bagging.
Castle & Gottheil, Megantic, London, 152 bs. old paper.
George Stratford, by same, 90 bs. rope.
R. H. Overton & Son, by same, 57 bs. rags.
Castle & Gottheil, by same, 64 bs. rags.
H. P. Ramsdell, Carrie Eisler, Nova Scotia, 260 ts. chemical fibre.
Train, Smith & Co., Spaarndam, Rotterdam, 97 bs. rags.
W. H. Vandertoon, by same, 11 bs. bagging.
Castle & Gottheil, by same, 15 ts. chemical fibre.
H. Dutton & Co., Island, Stettin, 47 bs. rags.

Paper.

Kupfer Brothers, Westernland, Antwerp, 23 cs.
F. B. Vandergrift & Co., by same, 7 cs.
L. C. Wagner & Co., by same, 5 cs.
J. W. Hampton, Jr., & Co., by same, 20 cs.
W. H. Stiner & Co., by same, 14 cs.
Paul Ruttmann, by same, 5 cs.
Beatty & Frey, Liverpool, Havre, 3 cs.
Wm. Campbell & Co., Anchoria, Glasgow, 447 rolls.
L. De Jonge & Co., Spaarndam, Rotterdam, 38 cs.
A. V. Benoit, by same, 3 cs.
W. Wicke & Co., Saale, Bremen, 1 cs.
E. & H. T. Anthony & Co., Britannic, Liverpool, 1 cs.
G. W. Sheldon & Co., Munchen, Bremen, 15 cs.
E. T. Molloy, Chateau Lafitte, Bordeaux, 27 bales.
L. De Jonge & Co., Arabia, Hamburg, 16 cs.
W. H. S. Lloyd, St. Louis, London, 18 bales hangings.
Favor, Ruhl & Co., by same, 10 cs.
E. Fougera & Co., by same, 23 cs.
E. J. Riley, Etruria, Liverpool, 23 cs. hangings.
John Hunter, Colorado, Hull, 3 cs.
American Tobacco Company, La Normandie, Havre, 66 cs.
J. C. Druckleib, by same, 30 cs.
E. Majert, by same, 43 cs. hangings.
F. Beck & Co., by same, 4 cs. hangings.
E. C. Roberts & Co., by same, 4 cs. hangings.
Warren, Fuller & Co., by same, 3 cs. hangings.
J. P. McHugh & Co., by same, 1 cs. hangings.
F. J. Emmerich, by same, 1 cs. hangings.
Thomas Bulkley, by same, 1 cs. hangings.
John Campbell & Co., Berlin, Antwerp, 5 cs.
G. A. & E. Meyer, by same, 5 cs.
Scovill & Adams Manufacturing Company, by same, 3 cs.
W. H. Stiner & Co., by same, 11 cs.
Paul Ruttmann, by same, 10 cs.
J. W. Hampton, Jr., & Co., by same, 20 cs.

Bleaching Powder.

Fuerst Brothers & Co., Kensington, Antwerp, 60 cks.
J. L. & D. S. Riker, Bovic, Liverpool, 124 cks.

Caustic Soda.

Welsh, Holme & Co., Georgic, Liverpool, 50 cks.
Edward Hill's Son & Co., by same, 250 cks.

Soda Ash.

Wing & Evans, Bovic, Liverpool, 1,200 bgs.
J. L. & D. S. Riker, by same, 80 bgs.

BOSTON IMPORTS.

FROM FEBRUARY 10 TO FEBRUARY 16, 1898, INCLUSIVE.

Paper, Etc.

A. H. Davenport, Pavonia, Liverpool, 3 cs. paper hangings.
Henry A. Turner & Co., by same, 1 cs. paper hangings.
Retson & Foster, by same, 1 cs. paper hangings.
W. H. Guild & Co., by same, 6 bs. periodicals.
John Lane, by same, 11 cs. printed matter.
Bentley, Frazier & Co., Victorian, Liverpool, 1 cs. cigarette paper.
Dennison Manufacturing Company, Sachem, Liverpool, 11 bs. tissue paper.
Stain & Sons, Canada, Liverpool, 1 cs. printed bills.
Frost & Adams Company, Baltimore, London, 1 cs. paper.

Paper Stock.

Train, Smith & Co., Georgian, London, 160 bs. waste paper.
W. F. Carne, by same, 17 bs. rags.
Geo. Wheelwright Paper Company, by same, 58 bs. waste paper.
T. Westhorp & Co., by same, 124 coils manillas.
G. W. Millar & Co., Baltimore, London, 37 bs. waste paper.
T. Westhorp & Co., by same, 95 bags manillas.
E. Butterworth & Co., Pavonia, Liverpool, 240 bs. rags.
W. F. Carne, Victorian, Liverpool, 102 bs. rags.
E. Butterworth & Co., Sachem, Liverpool, 63 bs. waste paper, 67 bs. manillas.
W. F. Carne, by same, 25 bs rags.
Horace Dutton & Co., by same, 25 bs. rags.
E. Butterworth & Co., Canada, Liverpool, 50 bs. manillas.

Sizing.

E. Butterworth & Co., Sachem, Liverpool, 170 bags.
Baeder, Adamson & Co., by same, 201 bags.
Train, Smith & Co., Victorian, Liverpool, 55 bags.
E. Butterworth & Co., by same, 250 bags.
E. Butterworth & Co., Pavonia, Liverpool, 158 bags.

Wood Fibre.

Page, Newhall & Co., Georgian, London, 170 bs.

Bleaching Powder.

Jerome Marble, Victorian, Liverpool, 41 csks.
J. L. & D. S. Riker, Sachem, Liverpool, 225 csks.
J. L. & D. S. Riker, Canada, Liverpool, 156 csks.

Soda Ash.

Warren & Co., Sachem, Liverpool, 34 csks.
Wing & Evans, Victorian, Liverpool, 155 csks.

Soda Crystals.

Warren & Co., Sachem, Liverpool, 280 bbls.

Alkali.

Linder & Meyer, Victorian, Liverpool, 20 csks.

Crude Sulphur.

Linder & Meyer, Victorian, Liverpool, 334 bags.

EXPORTS FROM NEW YORK.

FROM FEBRUARY 8 TO FEBRUARY 15, 1898.

BOOKS, to Antwerp, 1 cs.; Brazil, 1 cs.; British West Indies, 4 pkgs.; Bremen, 4 cs.; Copenhagen, 1 cs.; Central America, 5 pkgs.; Cuba, 2 cs.; China, 2 cs.; Christiania, 1 cs.; Hamburg, 10 pkgs.; Japan, 6 cs.; Liverpool, 9 cs.; London, 7 cs.; Mexico, 2 cs.; Stockholm, 2 cs.; San Domingo, 4 cs.; Southampton, 1 cs. Totals—44 cs., $3,119; 19 pkgs., $820.

CARDS, cases, to London, 3, $60.

LABELS, cases, to Hamburg, 2; Newfoundland, 2; San Domingo, 1. Totals—5 cs., $474.

LITHOGRAPHS, cases, to London, $716.

NEWSPAPERS, to London, 236 bdls.; Mexico, 12 cs.; Manchester, 289 pkgs. Totals—289 pkgs., $4,368; 236 bdls., $1,886; 12 cs., $30.

PAPER, to Argentine Republic, 5 cs.; Berlin, 4 cs.; Belfast, 1 cs.; Bremerhaven, 10 cs.; British Australasia, 2 cs.; British Africa, 20 pkgs.; Brussels, 2 pkgs.; Brazil, 244 pkgs.; Bristol, 236 pkgs.; British West Indies, 604 pkgs.; Central America, 1 pkg.; Cuba, 4 pkgs., 8 bs.; Dutch West Indies, 18 pkgs.; Hull, 22 pkgs.; Hayti, 6 pkgs.; Hamburg, 6 bdls.; Japan, 3,708 pkgs.; Liverpool, 23 cs., 860 bdls.; London, 3,347 pkgs., 168 bdls.; Moscow, 1 cs.; Mexico, 38 pkgs.; Manchester, 671 bdls.; 398 pkgs.; Newcastle, 174 pkgs.; San Domingo, 26 pkgs.; Southampton, 76 pkgs.; United States of Colombia, 31 pkgs.; Venezuela, 72 pkgs. Totals—9,027 pkgs., $51,828; 1,705 bdls., $3,497; 46 cs., $866; 8 bs., $114.

PAPER BAGS, to British Australasia, 12 bs.; British Africa, 20 bs.; Brazil, 14 bs.; British West Indies, 4 bdls.; Cuba, 1 pkg.; Hamburg, 1 bl.; British Guiana, 19 bdls. Totals—47 bs., $304; 23 bdls., $135; 1 pkg., $96.

PAPER BOXES, to British Africa, 1 pkg.; Japan, 36 cs. Totals—36 cs., $1,056; 1 pkg., $18.

PAPER CAPS, cases, to Mexico, 1, $15.

PERIODICALS, to Havre, 9 cs.; London, 12 pkgs. Totals—9 cs., $440; 12 pkgs., $195.

PHOTOGRAPHS, cases, to Antwerp, 1; Liverpool, 3; London, 1. Totals—5 cs., $80.

PICTURES (other than oil), to Antwerp, 1 pkg.; British Australasia, 2 cs.; British Africa, 1 cs.; Bremen, 2 cs.; Christiania, 2 cs.; Hamburg, 14 pkgs.; Liverpool, 7 cs.; London, 7 cs.; Munich, 3 cs.; Southampton, 1 cs. Totals—25 cs., $4,312; 15 pkgs., $344.

PLAYING CARDS, cases, to Berlin, 1; British Africa, 4; Brazil, 1; London, 17. Totals—23 cs., $1,420.

PRINTED MATTER, to Antwerp, 3 pkgs.; Budapest, 1 cs.; British Australasia, 14 cs.; British Africa, 8 cs.; Brazil, 6 cs.; British West Indies, 3 cs.; Copenhagen, 10 cs.; Cuba, 3 cs.; China, 1 cs.; Christiania, 2 cs.; Hamburg, 23 pkgs.; Liverpool, 58 cs.; London, 104 cs.; Mexico, 1 cs.; New Zealand, 1 cs.; Southampton, 35 pkgs.; United States of Colombia, 1 cs.; Berlin, 3 cs. Totals—216 cs., $14,644; 61 pkgs., $7,059.

STATIONERY, to Belfast, 2 cs.; British Australasia, 8 cs.; Brazil, 14 cs.; British West Indies, 20 pkgs.; Central America, 3 pkgs.; Cuba, 2 cs.; Christiania, 32 cs.; Dutch West Indies, 2 pkgs.; Drammen, 17 cs.; Hull, 3 cs.; Havre, 3 cs.; Japan, 16 cs.; Liverpool, 1 cs.; London, 152 cs.; Mexico, 40 cs.; San Domingo, 5 cs.; Southamptop, 27 cs.; United States of Colombia, 3 pkgs.; Venezuela, 5 pkgs. Totals—322 cs., $19,551; 33 pkgs., $557.

TAGS, cases, to Mexico, 1, $99.

TWINE, to Brazil, 16 bs., 9 cs.; British West Indies, 4 bs.; Hamburg, 12 bdls.; Mexico, 2 bs.; Manchester, 2 bbls.; Newfoundland, 13 bs.; San Domingo, 3 bs.; Venezuela, 26 bs. Totals—64 bs., $1,183; 9 cs., $126; 2 bbls., $47; 12 bdls., $33.

WALL PAPER, to Hamburg, 3 pkgs.; London, 14 cs.; Mexico, 44 cs. Totals—58 cs., $604; 3 pkgs., $55.

ALKALI, bags, to Mexico, 85, $173.

CAUSTIC SODA, drums, to Central America, 7; Venezuela, 5. Totals—12 ds., $214.

CLAY, to Antwerp, 150 bbls.; Bremen, 320 cks.; Mexico, 50 bbls. Totals—200 bbls., $600; 320 sks., $315.

COTTON WASTE, bales, to Cuba, 1; Hamburg, 1,523; Rotterdam, 15; Venezuela, 2. Totals—1,541 bs., $26,117.

RAGS, bales, to Hamburg, 244, $2,858.

ROSIN, barrels, to British Africa, 4; Brazil, 835; British West Indies, 60; Central America, 32; London, 160; United States of Colombia, 30; Venezuela, 430. Totals—1,551 bbls., $4,474.

SANDPAPER, to Antwerp, 77 pkgs.; Brazil, 6 cs, 1 bl.; Cuba, 9 bdls.; Denton, 7 bdls.; Hamburg, 17 bdls.; Japan, 12 cs.; London, 91 bdls.; Mexico, 2 bdls.; Stettin, 7 bs.; Venezuela, 3 bs. Totals—126 bdls., $1,488; 18 cs., $445; 77 pkgs., $816; 11 bs., $61.

TALC, barrels, to Japan, 5, $53.

WASTE, bales, to Dutch West Indies, 2, $15.

WOOD PULP, rolls, to Antwerp, 1,605, $3,439.

Total exports for the week, $7,918,861.

Litigation Over Envelope Plant.

Out in Omaha they have been having trouble over the removal of an envelope plant, and in a recent issue of a local paper the story is told as follows:

The litigation started some time ago between the Carpenter Paper Company and the Western Envelope Company is assuming an iridescent hue, and is evolving as many points of law as ever tangled the heads of the barristers in Jarndyce vs. Jarndyce of Dickens fame.

The litigation was commenced by the Carpenter Paper Company levying on the property of the Western Envelope Company by virtue of a chattel mortgage for something like $3,000. The evening of the same day the envelope company obtained from Judge Scott a restraining order to prevent the paper company's levy, and during the court's vacation there has been a battle royal of affidavits, counter affidavits, pleadings and objections to pleadings, until the record has assumed a corpulent shape.

The last act in the continuous play occurred about midnight Saturday, when a race ensued between the menials of justice and the servants of the envelope company for the possession of the property involved.

During the day, Saturday, the envelope company obtained from Judge Scott permission to pay into the clerk of the court the amount of the paper company's claim, and to take the property, the court presuming that such payment would be a settlement of the litigation. After much figuring, the amount of the claim was determined, and a check was given to the clerk of the court.

But there was a string tied to the check. It was presented only on the condition that the money would remain in the clerk's possession until the litigation should end, which consummation is in the dim and distant future. This state of affairs was not comprehended in the order of the court.

The envelope company, however, went ahead getting out its machinery and preparing it for shipment, having a force of about twenty-five men at work. Late in the evening the paper company, acting upon the fact that the order had not been strictly complied with in the payment of the money, hied itself to the judge, and with hasty strides an order was carried down to the envelope factory which required the men to desist from their labors. The work was stopped between midnight and 1 A. M., Sunday.

This morning the parties appeared before Judge Scott, and dissertations on the right of each side in the case ensued, with the result that the attorneys concluded to put their heads together and see if some settlement could not be obtained.

Another move in the matter at issue was the filing this morning of a bill of sale, by which the envelope company transfers to Frank F. Noleman, the machinery, etc., of the plant, the consideration mentioned in the instrument being $3,800.

The outcome of the consultation of the attorneys has not yet been made known.

Trades Union Labels Protected.

The Supreme Court, Boston, Mass., in the case of Thomas F. Tracy, vice-president of the Cigar Makers' International Union of America, vs. Joseph Baker, by a unanimous decision has ordered a decree for the plaintiff. The suit was brought under the law forbidding the fraudulent use of trades union labels. The court holds that this statute protects such trades unions, as well as merchants, and that manufacturers must stop unauthorized use of union labels as well as counterfeits of them.

The La Plata (Mo.) Home Press has been sold at mortgage sale, and was bought by D. A. Guthrie. The Home Press is one of the oldest papers in North Missouri, and was established in 1873 by J. B. Thompson.

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EXPERT IN THE SULPHITE PROCESS AND ALL CHEMICAL MATTERS PERTAINING TO THE MANUFACTURE OF PULP AND PAPER.

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Manufacturers of **Alum.**
Highest tests, free from iron, and all other grades used by paper makers.
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Old Linen and Cotton Rags, New Cuttings,
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SULPHITE AND SODA PULPS.

AMERICAN PAPER AND PULP ASSOCIATION.

(*Continued from page 166.*)

newspaper never even approximately represents the ideal of its editor. The newspaper man's ideal, if it could be materialized in actual fact, would be a brilliant failure. Not even the combined fortunes of a Rockefeller, a Vanderbilt and a Gould could give vitality and influence to the impracticable and impossible thing newspaper men picture as their ideal newspaper. No editor who is successful and practical ever cherishes any vain dream of a time to come when his ideal newspaper will take form and shape under his guiding care. The successful editor puts behind him all ambition to print a model journal, and, wisely recognizing the shackles of his environment, endeavors to make the kind of a newspaper he thinks people will read, and not the kind of newspaper he thinks they ought to read. (Laughter and applause.) The editor who knows aught of newspaper making, who has mastered the elementary rudiments of the art, makes it his constant aim to be in close and intimate touch with the feeling, the sentiment, the conscience of those he seeks as his patrons. If he is able to do that and to keep abreast at all times with the enterprise and the progress of the community in which his paper circulates influence, power and material success are sure to be his. If he is keen in discerning the tendencies of the people, quick in observing the opportunities for progress, ready in seizing the occasion for aggressive action, he is sure to rise above the shallows of mediocrity, and is certain to take rank as a true leader of the people.

The touchstone of all editorial success, the impulse back of every widely circulated newspaper, is always the same. However details may differ in individual instances, whenever a newspaper has grown big and strong and popular through years, you will always find that the one simple secret of it all lies in its faithful reflection of the light, the spirit, the very being of the people who read it. (Applause.) Readers differ in their attitude toward newspapers; yet the editor who goes about it in the right way may readily lead the readers, while he can never drive them. The American editor has learned that lesson of wisdom, and he puts it to practice. So the American newspaper worthily wears laurels deservedly won in royal service as a leader of the people (applause); fully representative of American spirit in every form the American newspaper has naturally outstripped the press of the whole world. (Applause.) Its characteristics are essentially those of the American people, and you know they always move in the front rank of modern progress. Advance agents of civilization are they. Their free and unfettered press, marching at the head of the column, chosen heralds who daily proclaim to a waiting world, wondering and amazed, the latest achievements of American genius (applause); forging onward with the impetuous energy that is the distinguishing characteristic trait of the American people, the American newspaper has been a constant stimulus for the creative and commercial genius! The resistless force driving it onward and ceaselessly demanding enlarged resources, improved facilities in every department of activity, has been a perpetual inspiration and incentive for the inventor and the manufacturer. Splendidly, too, have they responded. The American manufacturers of machinery, the American manufacturers of paper, have kept even pace with the development of the American newspaper, meeting every requirement promptly, and putting possibilities within the range of editors and publishers they would never have dreamed of if they had not been favored with labor-saving linotypes, fast presses, and cheap paper. (Applause.)

Knowing the rank the American newspaper thus admittedly holds in the world, we of the fourth estate feel that we have the right to pride. Yet we must modestly confess that in one thing at least we have been outstripped and outdone by our three great allies—the linotype, the press and the paper manufacturer. American linotypes and American presses have captured and securely hold the foreign field. American paper has invaded the same field, and doubtless will eventually complete a similar capture. The American newspaper, though, can make no such boast. We keep you company as far as the boundary line of the United States, but there we voluntarily part. Beyond you may carry your conquering banners, but you go alone. Our mission is at home; we hold to a rigid enforcement of the Monroe doctrine. The American newspaper seeks no constituency in a foreign land; it wants no circulation under the shadow of an alien flag. (Applause.) It would be untrue to its Americanism, unfaithful to all its principles, unworthy the place it holds as the true leader of the people if it could ever be so un-American that it could thrive anywhere, except on the soil of liberty and under the flag of freedom. (Applause.)

The President—Gentlemen, our second toast is "The Triumph of a Useful Art," and will be responded to by the leader of the bar of Maine, a scholar and a gentleman, whom we at home all regard with pride. I take pleasure in introducing to you Judge Joseph W. Symonds. (Applause.)

RESPONSE OF JOSEPH W. SYMONDS.

I remember reading of a Roman noble who was accustomed to expend vast sums of money in the purchase of learned slaves. At his command one slave recited to him the "Iliad" or the "Odyssey," another the "Oration for the Crown;" a third, some chapters from Livy, or an ode of Horace, and so on through all the range of the ancient classics. It was his ambition to have the best poets, orators and historians in living editions, subject always to his will—to the mood of the moment. What happened or what was done, when the deputy Homer or Demosthenes, Livy or Horace was indisposed or absent, so far as I know the record does not disclose.

This haughty Roman amateur, with his retinue of scholarly slaves, with the dainty and dilettante exclusiveness it implies, may be taken as the type of the ancient world of his own age and class, the solid block of barbarian in him relieved and overlaid only by a thin polish of gentleman and scholar upon the surface, and the only regret concerning him worth while to mention being in the fact that specimens of his kind, more or less exact, survive to our times.

In contrast with all this, for symbols of modern life we may take the two great inventions—printing and paper making—each elaborated, refined and perfected during the course of the last 500 years; yoke-fellows always, inseparable companions on the way, bringing to the cottager's door the world over, to the humblest fireside, the marvels of the literatures of all times, making it possible for the hand which holds the sickle or the spade by day, if it will, to hold the Homer of Bryant, the Dante of Longfellow, Shakespeare, Milton, Wordsworth, or the Bible, at night. (Applause.)

In all history and poetry the advent of the arts is celebrated as among the most welcome events in the progress of mankind. They are the noblest companions of human history, and an improvement in them is always a social advance. From the first rude attempts of men in metal working to Cellini's skill the distance seems as vast as to the spears and shields of the celestial host, seen by Milton in his blindness, "hung high with diamonds flaming." Barbarism builds its rude shelter from the storm or cold, or from the tropical heats, and from that to the Pyramids and the Parthenon the progress is unbroken. Superstition and the hideous altars it has erected pass away, while the conscious stone to beauty grows under

> The hand which rounded Peter's dome
> And groined the aisles of Christian Rome.

What art so useful or fine, or so old, as the art of writing. Inscriptions on buried titles or cut in stone are all we know of the early civilizations. Beside brick and stone to write upon, classical antiquity had, too, its tables of wood or wax, of ivory, bronze or gold, its rolls of lead or parchment or papyrus, and, later, the bark or leaves of vegetable growths, the leaf of a book being only a reminiscense of the time when its pages were written upon the leaves of the wood or the garden. Bibles written upon palm leaves, it is said, are still extant.

The art of illumination during the Middle Ages filled church and castle with manuscripts which were in themselves not only works of art but objects of luxury, and are still the treasures of our libraries and museums. But these were for noble or priest or king, not for the people. With infinite labor the monks consumed their lives in copying the classics or in illuminating missals or other manuscripts, while without the gates of their monasteries tumult and violence and war raged unheeded, the laws of humanity swept away in the storm. Literature had still the old classic hatred for the vulgus profanum, sharing the monk's seclusion or an occasional guest at the homes of the great. There was no attempt to popularize it, to broaden its domain, to diffuse it through society, and no means of accomplishing this if the attempt had been made. The Gothic night had descended upon Europe, and only here and there, at scattered shrines, in silence and shadow, the ritual of Genius continued to be solemnized. But its fire still burned, and torch after torch was soon to carry the flame over the world. (Applause.)

What the world was searching for—and vainly sought so long—was some means of multiplying copies of books without writing them out by hand, without making them one by one, and some light and cheap material on which that art, when discovered, could be expanded. When the art of paper making came from the East by way of Granada and the Moors into Spain, and by the Arab occupation of Sicily into Italy, and had become an established interest and industry of Europe, and movable types at about the same time had become known, then the new era had dawned, the modern life had begun. The future lay enfolded in these two discoveries as the flower in the bud. But who would have ventured to predict, who could have anticipated, the actual results of either discovery, the amazing achievements and beneficence of either art, the perfection of modern machinery and its strange capabilities, transforming a forest into paper and freighting it with the news and thought of the day in the interval

> Between the lark's note and the nightingale's?

"Twin-lights of England," wrote De Quincey, of Oxford and Cambridge, with their shining traditions of a thousand years. "Twin-lights of civilization," we may say of these two great arts, their rays the brightness of a new day for all the world. Well may we repeat that here, as elsewhere in these fields, as in all other fields, the triumphs of invention and discovery in the useful arts are among the true glories of modern life.

There is somehow a sort of witchery about a sheet of paper. It seems to be charged with thought as the flint carries fire. It is common now, but the men of a former generation always regarded it with a kind of sanctity. It has kept high company, has lived with the poets and known their moods. It is associated with books—with the long life of the best books. Slight as is the fabric of it, it holds the memory of men of genius, of the departed kings of learning and guards their repose in the eternal pyramids of fame. "The dart that pierced the Persian breastplate moulders in the dust of Marathon, but the arrow of Pindar quivers at this hour with the life of his bow."

But there is another side to all this. There are skeptics still among us who doubt whether the liberty of unlicensed printing is the unmixed good it has been imagined to be, and who might be bold enough to deny the propriety of transforming the woods into material for books and newspapers. If the question were fairly to arise between some books and some journals on the one hand and some trees on the other, most of us, I suppose, would prefer to hold a brief for the trees. Many a tree, if it could be heard in a fair case against some books, might justify resistance on the ground that it is not according to the law of nature for the higher thing to be sacrificed to the lower use.

(*Continued on page 172.*)

Market Review.

OFFICE OF THE PAPER TRADE JOURNAL,
FRIDAY, February 18, 1898.

THE MONEY MARKET.—The stock market was feverish, responding to each change in the character of the Cuban advices. Call loans on stock collateral were steady at an average of 1¼@1½ per cent., with most business at the higher rate. For call loans banks and trust companies seek to maintain 2 per cent. as the minimum, but most new business is done at lower rates. The inquiry for time loans is fairly good, but offerings are ample for the market's needs. Rates are 2@2½ per cent. for sixty to ninety days, and 2½@3 for four to seven months on good mixed Stock Exchange collateral. The commercial paper market is fairly supplied with good material. Rates are 3 per cent. for sixty to ninety-day indorsed bills receivable, 3¼@4 per cent. for prime and 4@5 per cent. for good four to six months' single names not so well known. The foreign exchange market was steady to firm in tone. Posted rates were $4.84 for sixty days and $4.86½ for sight. Actual rates were $4.83@4.83½ for sixty days and $4.85⅜@4.86¼ for sight.

THE PAPER TRADE.—The majority of the down East mills are running on full time, orders are plentiful and the outlook is excellent for a steady run. Manufacturers report trade far ahead of February, 1897. Local interest this week centred in the annual meeting of the National Association held at the Waldorf-Astoria. The gathering was a notable one in many ways. It brought out some interesting facts and figures concerning the big export business doing in paper and the possibilities of increasing this trade.

JUTE BUTTS.—The market for Jute Butts was quiet. The price is .75c.

WOOD PULP.—Ground Wood was in fair call. The price is about $13 f. o. b. at the pulp mill.

WOOD FIBRE.—Foreign Sulphite shows no change. The domestic article was in fair call. We quote: Foreign Sulphite, bleached, No. 1, 3.25@3.30c.; No. 2, Soda Fibre, bleached, is quoted at 2.70@2.80c.; unbleached, No. 1, 2.15c.; No. 2, 2.10c. Domestic Sulphite, unbleached, regular grades, is quoted at 1.62@2c.; Selected Quality, 2¼@2.35c.; Domestic Soda, bleached, 1.70@2c. delivered. There were 315 tons of wood fibre imported at New York this week, being 30 tons from Antwerp, 10 tons from Hull, 260 tons from Nova Scotia and 15 tons from Rotterdam.

FOREIGN RAGS AND PAPER STOCK.—The market for Foreign Rags was quiet. No sales were reported: We quote: German Blue Cottons, 1.20@1.25c.; Dutch Blues, 1¼@1.30c.; Light Prints, 1.15@1.20c., according to quality; New Cuttings, 2¾@2½c. The imports for the week aggregated 3,391 bales and 315 tons, being 1,046 bs. rags, 301 bs. old papers, 2,044 bs. manillas, and 315 tons chemical fibre. The ports of shipment and quantities were as follows: Antwerp, 296 bs. rags, 30 tons chemical fibre; Genoa, 682 bs. manillas; Glasgow, 43 bs. rags, 100 bs. old papers; Hamburg, 295 bs. rags, 229 bs. manillas; Hull, 147 bs. rags, 10 tons chemical fibre, 829 bs. manillas; Liverpool, 49 bs. old papers, 62 bs. manillas; London, 121 bs. rags, 152 bs. old papers, 90 bs. manillas; Nova Scotia, 260 tons chemical fibre; Rotterdam, 97 bs. rags, 15 tons chemical fibre, 11 bs. manillas; Stettin, 47 bs. rags; Havre, 141 bs. manillas.

DOMESTIC RAGS.—The market for Domestics shows no new features. Prices are firmly held. We quote: Rag Muss, .50@.55c.; Satinette, .55@.60c.; Common Dark Seconds, .70@.75c.; Mixed Cottons, .70@.80c.; Thirds and Blues, 1⅛@1⅜c.; Thirds and Blues (street), 1@1⅛c.; House Soiled Whites, 1¾@1⅞c.; Street Soiled Whites, 1¼@1½c.; No. 1 Whites, 2¾@3c.; New Black Cottons, .50@.60c.; New Common Dark Seconds, .65@.75c.; New Dark Cottons, .75@1¼c.; New Blue Cottons, 2@2½c.; New Light Seconds, 2½@3¼c.; New White Shirt Cuttings, No. 2, 3@3½c.; New White Cuttings, No. 1, 4@4½c.

BAGGING.—The market for Gunny Bagging holds firm. A sale of 150 tons at 67½c. was reported. The price is 67½@70c. Manilla Rope is quoted as selling at 1.67½c. Bright Burlaps at 85c.. No. 1 Mixed Bagging at .55@.60c. and Heavy Wool Tares at .90@.92½c. The manilla stock imports for the week aggregated 2,044 bs., being 682 bs. from Genoa, 229 bs. from Hamburg, 829 bs. from Hull, 62 bs. from Liverpool, 90 bs. from London, 11 bs. from Rotterdam and 141 bs. from Havre.

OLD PAPER.—The market for Old Papers was quiet. Favors were distributed among the leading grades. We quote: No. 1 Hard White Shavings, 2@2¼c.; No. 1 Soft White do., strictly free from wood, 1.65@1.70c.; Soft White do., ordinary, 1.50c.; Ledgers, 1¼@1¾c.; Ledgers and Writings, 1.15@1.25c.; Solid Printed Books, 95c.@$1.05; Mixed Shavings, No. 1, 75c.@$1; No. 2, 60@65c.; Extra No. 1 Manillas, 1@1⅛c.; No. 1 Manillas, Ordinary, .70@.80c.; No. 2 Manillas, .55@.60c.; Folded News, .55c.; Folded News (over issues), .65c.; Crumpled News, .45@.50c.; Mixed Papers, .30@.40c.; Commons, .20@.25c.; Straw Clippings, .35@.37c.; Binders do., .40@.45c.

STRAW.—Offerings were moderate. Trade was slow. We quote: Long Rye, .45@.50c.; Short Rye, .30@.40c.; Oat, .25@.35c.

ROSINS.—The common and medium grades were in moderate request. We quote: Common to Good Strained, $1.65@1.70; E, $1.75@1.77½; F, $1.82½@1.85; G, $1.90@1.95; H, $2@2.05; I, $2.10@2.15; K, $2.25@2.30; M, $2.35; N, $2.45; W G, $2.70@2.75.

CHEMICALS.—The feature of the week in the market for paper makers' chemicals was the large business doing in Domestic Alkali for forward delivery. J. P. Brunner & Co., in their last letter from Liverpool, say: "The recent improved tone in heavy chemicals is maintained, but there is little change in the position since our last report. Soda Ash, while not brisk, is firmly held. The range for tierces, according to market, may be called about as follows: Leblanc Ash, 48 per cent., £4 10s.@4 15s. per ton; 58 per cent., £4 15s.@5 per ton; Ammonia Ash, 48 per cent., £4@4 5s. per ton; 58 per cent., £4 5s.@4 10s. per ton, net cash. Bags, 5s. per ton under price for tierces. Soda Crystals meet with a fair amount of attention from buyers, and £2 17s. 6d. per ton, less 5 per cent., is still the general quotation for barrels, while bags are 7s. per ton less. Special terms for American business. Caustic Soda is scarce for prompt delivery, and quotations are firm at the following range, as to market, viz., 60 per cent., £6 5s.@6 10s. per ton; 70 per cent. £7 5s.@7 10s. per ton, net cash; 74 per cent., £8@8 5s. per ton; 76 per cent., £8 10s.@8 12s. 6d. per ton. Bleaching Powder in moderate demand, and steady at £6@6 5s. per ton; net cash for hardwood packages, as to destination." In the local market English Bleach is quoted as selling at $1.87½; French Bleach, $1.25; German Bleach, $1.25; Foreign Alkali, in casks, 75c.; American Alkali, 70c.; U. A. Caustic Soda, $1.87½, with the American article at $1.85.

CHINA CLAY.—Spot stock of English continues rather light, as most of the arrivals go to fill contracts made some time since. The consuming demand is increasing, and the outlook for a good spring trade is held to be encouraging. A steady feeling prevails, and prices are maintained at the previous quotations of $15.50@17.50 for the better kinds, and $10@12.50 for medium and lower grades, according to quality and quantity. Domestic remains steady, under an improving demand.

TWINES.—The cordage combination has advanced the price of Manilla and Sisal goods, the new prices being 6 cents per pound and 6¼ cents for smaller quantities of the former, and 5¼ cents per pound and 5½ cents for smaller quantities of the latter. We quote: Sisal Hay, 4¾@5¼c.; Sisal Lath Yarn, 4¼c.; Jute Rope, 4½@5½c.; Twines—Jute, 18, 10½c.; 24, 10½c.; 36, 10c.; Jute and Hemp, 18, 13@14c.; 24, 12½@13½c.; 36, 12@13c.; Hemp, 18, 16c.; 24, 15½c.; 36, 15c.; Marlines, Jute, 4½, 7c.; 6, 7c.; 7, 6½c.; Jute and Hemp, 6, 9@11c.; 8, 8@10c.; American Hemp, 4½c.; 11c.; 6, 11c.; 8, 10c.; Russian Hemp, 4½, 11c.; 6, 11c.; 8, 10c.

COAL.—The Anthracite coal market developed increasing firmness. The demand was good.

EDWIN BUTTERWORTH & CO.,
MANCHESTER, ENGLAND,
PACKERS OF ALL KINDS OF
Paper Stock, Cotton Waste and Buffalo Sizing, Wood Pulp, Moist and Air Dry Pulp, Soda and Ground Pulp,
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The Largest Manufacturers of Paper Makers' Felts in the World.
Our wet machine or pulp felts are *unequaled* for *durability*.
For WRITING and LEDGER PAPERS We warrant a felt equal to anything imported.

EMERSON MFG. COMPANY'S NEW JORDAN.
DOUBLE CAPACITY.
NO MORE POWER.

See the Stands.
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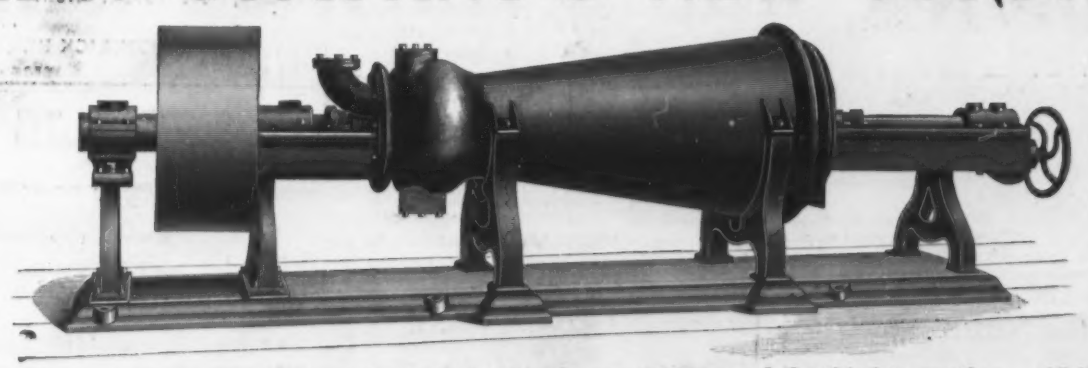

See the Taper Adjustment of Centering the Plug in Shell.
See the Continuous Sand Box on End of Shell.
See the Water Boxes for all Bearings.
See the Large Shaft.
See the Deep Head.

First one shipped in June, 1896, and we have already sent the sixth Jordan to one concern and the third to another. (All New Ideas and Practical Ones tell.)

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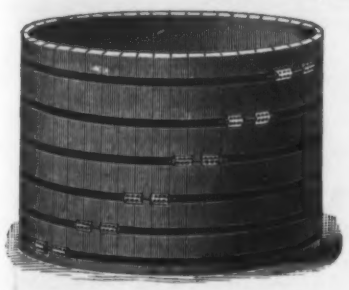

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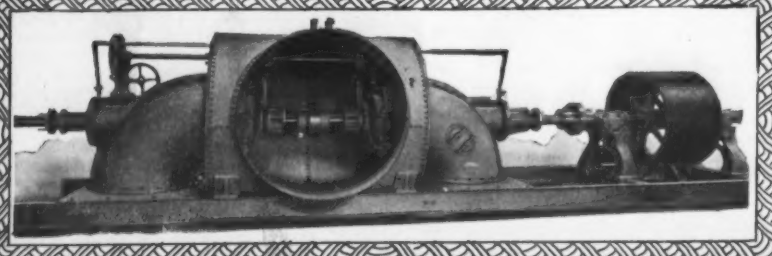

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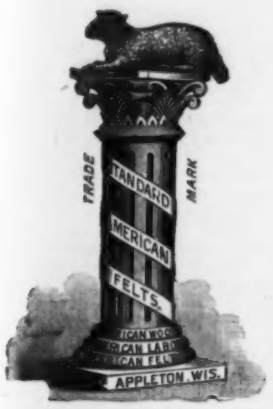

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Recent tests at Holyoke, given below, enable us to guarantee: *The Largest Power ever obtained from a wheel of the same diameter. The highest speed ever obtained for the same power. The highest mean efficiency when running from half to full gate.* We guarantee also: *A runner of the greatest possible strength. A gate unequaled in quickness and ease of opening and closing.*

These Wheels are SPECIALLY DESIGNED and ADAPTED to

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OBSERVE THE UNEQUALED SPEEDS, POWERS, AND EFFICIENCIES.

Test of a 45 inch SAMSON Wheel, Jan. 25, 1897.

Gate Open.	Head	Rev. Per Min.	Cu. Ft. Per Sec.	Horse Power.	Per Cent.
Full	15.00	144.00	173.69	240.97	82.03
7/8	15.04	138.12	155.03	223.61	84.56
3/4	15.11	127.67	133.24	191.06	83.68
5/8	15.88	131.50	112.65	169.80	80.35
1/2	16.47	126.87	90.04	127.73	75.95

Average efficiency 1/8 to full gate, 81.29 per cent.

Test of a 35 inch SAMSON Wheel, Feb. 1, 1897.

Gate Open.	Head	Rev. Per Min.	Cu. Ft. Per Sec.	Horse Power.	Per Cent.
Full	15.20	194.25	102.02	143.44	81.08
7/8	16.56	187.75	92.15	146.73	84.78
3/4	17.33	178.50	83.95	138.40	83.58
5/8	17.54	176.40	68.82	109.64	80.09
1/2	17.68	168.50	57.69	88.14	76.19

Average efficiency 1/8 to full gate, 81.20 per cent.

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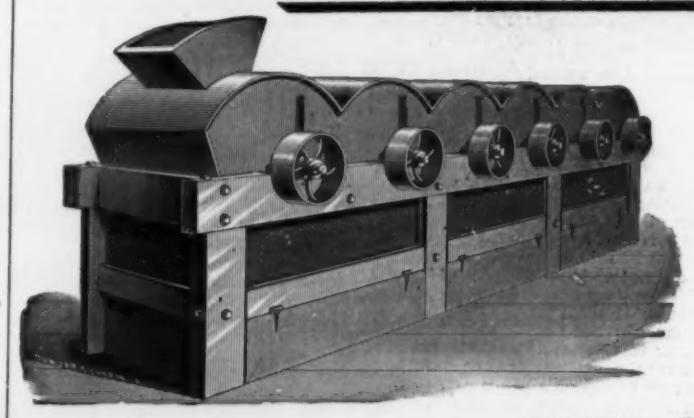

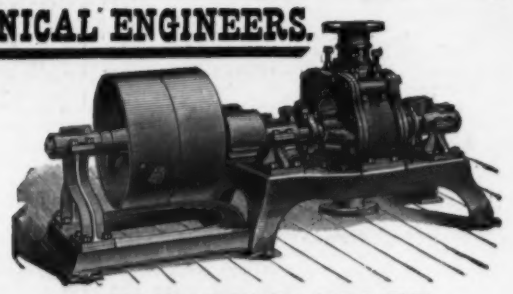

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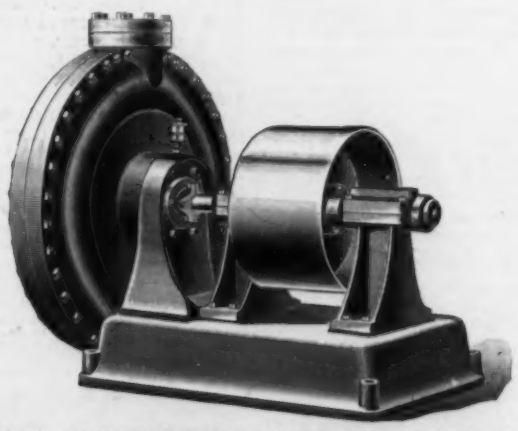

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LARGEST SHIPPING CAPACITY AND MOST COMPLETE CLAY WORKS IN THE UNITED STATES.

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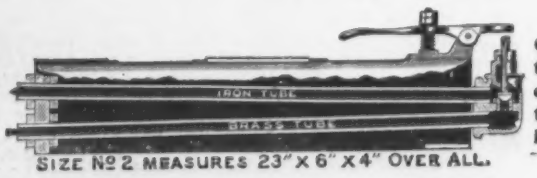

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AMERICAN PAPER AND PULP ASSOCIATION.

(*Continued from page 166.*)

newspaper never even approximately represents the ideal of its editor. The newspaper man's ideal, if it could be materialized in actual fact, would be a brilliant failure. Not even the combined fortunes of a Rockefeller, a Vanderbilt and a Gould could give vitality and influence to the impracticable and impossible thing newspaper men picture as their ideal newspaper. No editor who is successful and practical ever cherishes any vain dream of a time to come when his ideal newspaper will take form and shape under his guiding care. The successful editor puts behind him all ambition to print a model journal, and, wisely recognizing the shackles of his environment, endeavors to make the kind of a newspaper he thinks people will read, and not the kind of newspaper he thinks they ought to read. (Laughter and applause.) The editor who knows aught of newspaper making, who has mastered the elementary rudiments of the art, makes it his constant aim to be in close and intimate touch with the feeling, the sentiment, the conscience of those he seeks as his patrons. If he is able to do that and to keep abreast at all times with the enterprise and the progress of the community in which his paper circulates influence, power and material success are sure to be his. If he is keen in discerning the tendencies of the people, quick in observing the opportunities for progress, ready in seizing the occasion for aggressive action, he is sure to rise above the shallows of mediocrity, and is certain to take rank as a true leader of the people.

The touchstone of all editorial success, the impulse back of every widely circulated newspaper, is always the same. However details may differ in individual instances, whenever a newspaper has grown big and strong and popular through years, you will always find that the one simple secret of it all lies in its faithful reflection of the light, the spirit, the very being of the people who read it. (Applause.) Readers differ in their attitude toward newspapers; yet the editor who goes about it in the right way may readily lead the readers, while he can never drive them. The American editor has learned that lesson of wisdom, and he puts it to practice. So the American newspaper worthily wears laurels deservedly won in royal service as a leader of the people (applause); fully representative of American spirit in every form the American newspaper has naturally outstripped the press of the whole world. (Applause.) Its characteristics are essentially those of the American people, and you know they always move in the front rank of modern progress. Advance agents of civilization are they. Their free and unfettered press, marching at the head of the column, chosen heralds who daily proclaim to a waiting world, wondering and amazed, the latest achievements of American genius (applause); forging onward with the impetuous energy that is the distinguishing characteristic trait of the American people, the American newspaper has been a constant stimulus for the creative and commercial genius! The resistless force driving it onward and ceaselessly demanding enlarged resources, improved facilities in every department of activity, has been a perpetual inspiration and incentive for the inventor and the manufacturer. Splendidly, too, have they responded. The American manufacturers of machinery, the American manufacturers of paper, have kept even pace with the development of the American newspaper, meeting every requirement promptly, and putting possibilities within the range of editors and publishers they would never have dreamed of if they had not been favored with labor-saving linotypes, fast presses, and cheap paper. (Applause.)

Knowing the rank the American newspaper thus admittedly holds in the world, we of the fourth estate feel that we have the right to pride. Yet we must modestly confess that in one thing at least we have been outstripped and outdone by our three great allies—the linotype, the press and the paper manufacturer. American linotypes and American presses have captured and securely hold the foreign field. American paper has invaded the same field, and doubtless will eventually complete a similar capture. The American newspaper, though, can make no such boast. We keep you company as far as the boundary line of the United States, but there we voluntarily part. Beyond you may carry your conquering banners, but you go alone. Our mission is at home; we hold to a rigid enforcement of the Monroe doctrine. The American newspaper seeks no constituency in a foreign land; it wants no circulation under the shadow of an alien flag. (Applause.) It would be untrue to its Americanism, unfaithful to all its principles, unworthy the place it holds as the true leader of the people if it could ever be so un-American that it could thrive anywhere, except on the soil of liberty and under the flag of freedom. (Applause.)

The President—Gentlemen, our second toast is "The Triumph of a Useful Art," and will be responded to by the leader of the bar of Maine, a scholar and a gentleman, whom we at home all regard with pride. I take pleasure in introducing to you Judge Joseph W. Symonds. (Applause.)

RESPONSE OF JOSEPH W. SYMONDS.

I remember reading of a Roman noble who was accustomed to expend vast sums of money in the purchase of learned slaves. At his command one slave recited to him the "Iliad" or the "Odyssey," another the "Oration for the Crown;" a third, some chapters from Livy, or an ode of Horace, and so on through all the range of the ancient classics. It was his ambition to have the best poets, orators and historians in living editions, subject always to his will—to the mood of the moment. What happened or what was done, when the deputy Homer or Demosthenes, Livy or Horace was indisposed or absent, so far as I know the record does not disclose.

This haughty Roman amateur, with his retinue of scholarly slaves, with the dainty and dilettante exclusiveness it implies, may be taken as the type of the ancient world of his own age and class, the solid block of barbarian in him relieved and overlaid only by a thin polish of gentleman and scholar upon the surface, and the only regret concerning him worth while to mention being in the fact that specimens of his kind, more or less exact, survive to our times.

In contrast with all this, for symbols of modern life we may take the two great inventions—printing and paper making—each elaborated, refined and perfected during the course of the last 500 years; yoke-fellows always, inseparable companions on the way, bringing to the cottager's door the world over, to the humblest fireside, the marvels of the literatures of all times, making it possible for the hand which holds the sickle or the spade by day, if it will, to hold the Homer of Bryant, the Dante of Longfellow, Shakespeare, Milton, Wordsworth, or the Bible, at night. (Applause.)

In all history and poetry the advent of the arts is celebrated as among the most welcome events in the progress of mankind. They are the noblest companions of human history, and an improvement in them is always a social advance. From the first rude attempts of men in metal working to Cellini's skill the distance seems as vast as to the spears and shields of the celestial host, seen by Milton in his blindness, "hung high with diamonds flaming." Barbarism builds its rude shelter from the storm or cold, or from the tropical heats, and from that to the Pyramids and the Parthenon the progress is unbroken. Superstition and the hideous altars it has erected pass away, while the conscious stone to beauty grows under

> The hand which rounded Peter's dome
> And groined the aisles of Christian Rome.

What art so useful or fine, or so old, as the art of writing. Inscriptions on buried titles or cut in stone are all we know of the early civilizations. Beside brick and stone to write upon, classical antiquity had, too, its tables of wood or wax, of ivory, bronze or gold, its rolls of lead or parchment or papyrus, and, later, the bark or leaves of vegetable growths, the leaf of a book being only a reminiscense of the time when its pages were written upon the leaves of the wood or the garden. Bibles written upon palm leaves, it is said, are still extant.

The art of illumination during the Middle Ages filled church and castle with manuscripts which were in themselves not only works of art but objects of luxury, and are still the treasures of our libraries and museums. But these were for noble or priest or king, not for the people. With infinite labor the monks consumed their lives in copying the classics or in illuminating missals or other manuscripts, while without the gates of their monasteries tumult and violence and war raged unheeded, the laws of humanity swept away in the storm. Literature had still the old classic hatred for the vulgus profanum, sharing the monk's seclusion or an occasional guest at the homes of the great. There was no attempt to popularize it, to broaden its domain, to diffuse it through society, and no means of accomplishing this if the attempt had been made. The Gothic night had descended upon Europe, and only here and there, at scattered shrines, in silence and shadow, the ritual of Genius continued to be solemnized. But its fire still burned, and torch after torch was soon to carry the flame over the world. (Applause.)

What the world was searching for—and vainly sought so long—was some means of multiplying copies of books without writing them out by hand, without making them one by one, and some light and cheap material on which that art, when discovered, could be expanded. When the art of paper making came from the East by way of Granada and the Moors into Spain, and by the Arab occupation of Sicily into Italy, and had become an established interest and industry of Europe, and movable types at about the same time had become known, then the new era had dawned, the modern life had begun. The future lay enfolded in these two discoveries as the flower in the bud. But who would have ventured to predict, who could have anticipated, the actual results of either discovery, the amazing achievements and beneficence of either art, the perfection of modern machinery and its strange capabilities, transforming a forest into paper and freighting it with the news and thought of the day in the interval

> Between the lark's note and the nightingale's?

"Twin-lights of England," wrote De Quincey, of Oxford and Cambridge, with their shining traditions of a thousand years. "Twin-lights of civilization," we may say of these two great arts, their rays the brightness of a new day for all the world. Well may we repeat that here, as elsewhere in these fields, as in all other fields, the triumphs of invention and discovery in the useful arts are among the true glories of modern life.

There is somehow a sort of witchery about a sheet of paper. It seems to be charged with thought as the flint carries fire. It is common now, but the men of a former generation always regarded it with a kind of sanctity. It has kept high company, has lived with the poets and known their moods. It is associated with books—with the long life of the best books. Slight as is the fabric of it, it holds the memory of men of genius, of the departed kings of learning and guards their repose in the eternal pyramids of fame. "The dart that pierced the Persian breastplate moulders in the dust of Marathon, but the arrow of Pindar quivers at this hour with the life of his bow."

But there is another side to all this. There are skeptics still among us who doubt whether the liberty of unlicensed printing is the unmixed good it has been imagined to be, and who might be bold enough to deny the propriety of transforming the woods into material for books and newspapers. If the question were fairly to arise between some books and some journals on the one hand and some trees on the other, most of us, I suppose, would prefer to hold a brief for the trees. Many a tree, if it could be heard in a fair case against some books, might justify resistance on the ground that it is not according to the law of nature for the higher thing to be sacrificed to the lower use.

(*Continued on page 172.*)

Market Review.

OFFICE OF THE PAPER TRADE JOURNAL, FRIDAY, February 18, 1898.

THE MONEY MARKET.—The stock market was feverish, responding to each change in the character of the Cuban advices. Call loans on stock collateral were steady at an average of 1¼@1½ per cent., with most business at the higher rate. For call loans banks and trust companies seek to maintain 2 per cent. as the minimum, but most new business is done at lower rates. The inquiry for time loans is fairly good, but offerings are ample for the market's needs. Rates are 2@2½ per cent. for sixty to ninety days, and 2½@3 for four to seven months on good mixed Stock Exchange collateral. The commercial paper market is fairly supplied with good material. Rates are 3 per cent. for sixty to ninety-day indorsed bills receivable, 3¼@4 per cent. for prime and 4@5 per cent. for good four to six months' single names not so well known. The foreign exchange market was steady to firm in tone. Posted rates were $4.84 for sixty days and $4.86½ for sight. Actual rates were $4.83@4.83½ for sixty days and $4.85⅜@4.86¼ for sight.

THE PAPER TRADE.—The majority of the down East mills are running on full time, orders are plentiful and the outlook is excellent for a steady run. Manufacturers report trade far ahead of February, 1897. Local interest this week centred in the annual meeting of the National Association held at the Waldorf-Astoria. The gathering was a notable one in many ways. It brought out some interesting facts and figures concerning the big export business doing in paper and the possibilities of increasing this trade.

JUTE BUTTS.—The market for Jute Butts was quiet. The price is .75c.

WOOD PULP.—Ground Wood was in fair call. The price is about $13 f. o. b. at the pulp mill.

WOOD FIBRE.—Foreign Sulphite shows no change. The domestic article was in fair call. We quote: Foreign Sulphite, bleached, No. 1, 3.25@3.30c.; No. 2, Soda Fibre, bleached, is quoted at 2.70@2.80c.; unbleached, No. 1, 2.15c.; No. 2, 2.10c. Domestic Sulphite, unbleached, regular grades, is quoted at 1.62@2c.; Selected Quality, 2¼@2.35c.; Domestic Soda, bleached, 1.70@2c. delivered. There were 315 tons of wood fibre imported at New York this week, being 30 tons from Antwerp, 10 tons from Hull, 260 tons from Nova Scotia and 15 tons from Rotterdam.

FOREIGN RAGS AND PAPER STOCK.—The market for Foreign Rags was quiet. No sales were reported: We quote: German Blue Cottons, 1.20@1.25c.; Dutch Blues, 1¼@1.30c.; Light Prints, 1.15@1.20c., according to quality; New Cuttings, 2⅜@2½c. The imports for the week aggregated 3,391 bales and 315 tons, being 1,046 bs. rags, 301 bs. old papers, 2,044 bs. manillas, and 315 tons chemical fibre. The ports of shipment and quantities were as follows: Antwerp, 296 bs. rags, 30 tons chemical fibre; Genoa, 682 bs. manillas; Glasgow, 43 bs. rags, 100 bs. old papers; Hamburg, 295 bs. rags, 229 bs. manillas; Hull, 147 bs. rags, 10 tons chemical fibre, 829 bs. manillas; Liverpool, 49 bs. old papers, 62 bs. manillas; London, 121 bs. rags, 152 bs. old papers, 90 bs. manillas; Nova Scotia, 260 tons chemical fibre; Rotterdam, 97 bs. rags, 15 tons chemical fibre, 11 bs. manillas; Stettin, 47 bs. rags; Havre, 141 bs. manillas.

DOMESTIC RAGS.—The market for Domestics shows no new features. Prices are firmly held. We quote: Rag Muss, .50@.55c.; Satinette, .55@.60c.; Common Dark Seconds, .70@.75c.; Mixed Cottons, .70@.80c.; Thirds and Blues, 1⅛@1⅜c.; Thirds and Blues (street), 1@1⅛c.; House Soiled Whites, 1¾@1⅞c.; Street Soiled Whites, 1¼@1½c.; No. 1 Whites, 2¾@3c.; New Black Cottons, .50@.60c.; New Common Dark Seconds, .65@.75c.; New Dark Cottons, .75@1¼c.; New Blue Cottons, 2@2½c.; New Light Seconds, 2½@3¼c.; New White Shirt Cuttings, No. 2, 3@3½c.; New White Cuttings, No. 1, 4@4½c.

BAGGING.—The market for Gunny Bagging holds firm. A sale of 150 tons at 6⅞c. was reported. The price is 6⅞@7oc. Manilla Rope is quoted as selling at 1.67½c. Bright Burlaps at 85c.. No. 1 Mixed Bagging at .55@.60c. and Heavy Wool Tares at .90@.92½c. The manilla stock imports for the week aggregated 2,044 bs., being 682 bs. from Genoa, 229 bs. from Hamburg, 829 bs. from Hull, 62 bs. from Liverpool, 90 bs. from London, 11 bs. from Rotterdam and 141 bs. from Havre.

OLD PAPER.—The market for Old Papers was quiet. Favors were distributed among the leading grades. We quote: No. 1 Hard White Shavings, 2@2¼c.; No. 1 Soft White do., strictly free from wood, 1.65@1.70c.; Soft White do., ordinary, 1.50c.; Ledgers, 1¼@1⅜c.; Ledgers and Writings, 1.15@1.25c.; Solid Printed Books, 95c.@$1.05; Mixed Shavings, No. 1, 75c.@$1; No. 2, 60@65c.; Extra No. 1 Manillas, 1@1⅛c.; No. 1 Manillas, Ordinary, .70@.80c.; No. 2 Manillas, .55@.60c.; Folded News, .55c.; Folded News (over issues), .65c.; Crumpled News, .45@.50c.; Mixed Papers, .30@.40c.; Commons, .20@.25c.; Straw Clippings, .35@.37c.; Binders do., .40@.45c.

STRAW.—Offerings were moderate. Trade was slow. We quote: Long Rye, .45@.50c.; Short Rye, .30@.40c.; Oat, .25@.35c.

ROSINS.—The common and medium grades were in moderate request. We quote: Common to Good Strained, $1.65@1.70; E, $1.75@1.77½; F, $1.82½@1.85; G, $1.90@1.95; H, $2@2.05; I, $2.10@2.15; K, $2.25@2.30; M, $2.35; N, $2.45; W G, $2.70@2.75.

CHEMICALS.—The feature of the week in the market for paper makers' chemicals was the large business doing in Domestic Alkali for forward delivery. J. P. Brunner & Co., in their last letter from Liverpool, say: "The recent improved tone in heavy chemicals is maintained, but there is little change in the position since our last report. Soda Ash, while not brisk, is firmly held. The range for tierces, according to market, may be called about as follows: Leblanc Ash, 48 per cent., £4 10s.@4 15s. per ton; 58 per cent., £4 15s.@5 per ton; Ammonia Ash, 48 per cent., £4@4 5s. per ton; 58 per cent., £4 5s.@4 10s. per ton, net cash. Bags, 5s. per ton under price for tierces. Soda Crystals meet with a fair amount of attention from buyers, and £2 17s. 6d. per ton, less 5 per cent., is still the general quotation for barrels, while bags are 7s. per ton less. Special terms for American business. Caustic Soda is scarce for prompt delivery, and quotations are firm at the following range, as to market, viz., 60 per cent., £6 5s.@6 10s. per ton; 70 per cent. £7 5s.@7 10s. per ton, net cash; 74 per cent., £8@8 5s. per ton; 76 per cent., £8 10s.@8 12s. 6d. per ton. Bleaching Powder in moderate demand, and steady at £6@6 5s. per ton; net cash for hardwood packages, as to destination." In the local market English Bleach is quoted as selling at $1.87½; French Bleach, $1.25; German Bleach, $1.25; Foreign Alkali, in casks, 75c.; American Alkali, 70c.; U. A. Caustic Soda, $1.87½, with the American article at $1.85.

CHINA CLAY.—Spot stock of English continues rather light, as most of the arrivals go to fill contracts made some time since. The consuming demand is increasing, and the outlook for a good spring trade is held to be encouraging. A steady feeling prevails, and prices are maintained at the previous quotations of $15.50@17.50 for the better kinds, and $10@12.50 for medium and lower grades, according to quality and quantity. Domestic remains steady, under an improving demand.

TWINES.—The cordage combination has advanced the price of Manilla and Sisal goods, the new prices being 6 cents per pound and 6¼ cents for smaller quantities of the former, and 5¼ cents per pound and 5½ cents for smaller quantities of the latter. We quote: Sisal Hay, 4¾@5¼c.; Sisal Lath Yarn, 4¼c.; Jute Rope, 4½@5½c.; Twines—Jute, 18, 10½c.; 24, 10½c.; 36, 10c.; Jute and Hemp, 18, 13@14c.; 24, 12½@13½c.; 36, 12@13c.; Hemp, 18, 16c.; 24, 15½c.; 36, 15c.; Marlines, Jute, 4½, 7c.; 6, 7c.; 7, 6½c.; Jute and Hemp, 6, 9@11c.; 8, 8@10c.; American Hemp, 4½c.; 11c.; 6, 11c.; 8, 10c.; Russian Hemp, 4½, 11c.; 6, 11c.; 8, 10c.

COAL.—The Anthracite coal market developed increasing firmness. The demand was good.

EDWIN BUTTERWORTH & CO.,
MANCHESTER, ENGLAND,
PACKERS OF ALL KINDS OF
Paper Stock, Cotton Waste and Buffalo Sizing, Wood Pulp, Moist and Air Dry Pulp, Soda and Ground Pulp,
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Felts and Jackets
MANUFACTURED BY
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Adapted to *every* grade of paper from the *finest* to the *coarsest*.
The Largest Manufacturers of Paper Makers' Felts in the World.
Our wet machine or pulp felts are *unequaled* for *durability*.
For WRITING and LEDGER PAPERS We warrant a felt equal to anything imported.

EMERSON MFG. COMPANY'S NEW JORDAN.
DOUBLE CAPACITY. NO MORE POWER.
See the Stands.
See the Number of Supports.
See the Foundation.
See the Screw Arrangement.
See the Wide Bar.
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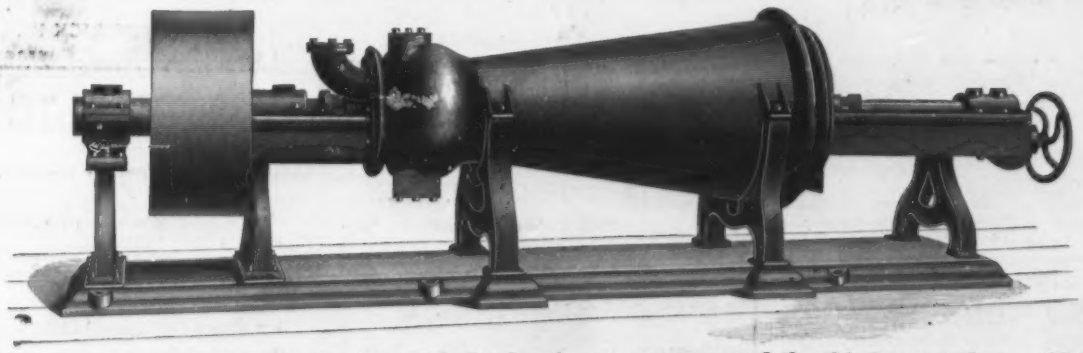
See the Taper Adjustment of Centering the Plug in Shell.
See the Continuous Sand Box on End of Shell.
See the Water Boxes for all Bearings.
See the Large Shaft.
See the Deep Head.
First one shipped in June, 1896, and we have already sent the sixth Jordan to one concern and the third to another. (All New Ideas and Practical Ones tell.)
EMERSON MANUFACTURING COMPANY, Lawrence, Mass.

ESTABLISHED 1840.

GEO. J. BURKHARDT'S SONS'

Cedar Tank Factory,

2831 TO 2839 NORTH BROAD ST.,

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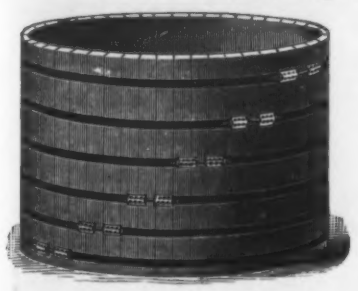

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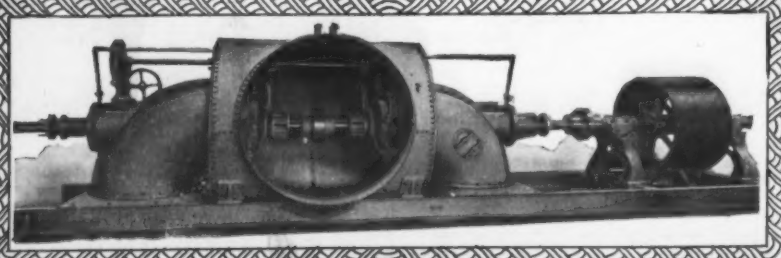

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We have not only demonstrated our ability to compete in all PAPER MAKERS' FELTS AND JACKETS, but in most lines claim to lead our competitors.

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LEFFEL **WATER WHEELS**

Recent tests at Holyoke, given below, enable us to guarantee: *The Largest Power ever obtained from a wheel of the same diameter. The highest speed ever obtained for the same power. The highest mean efficiency when running from half to full gate.* We guarantee also: *A runner of the greatest possible strength. A gate unequaled in quickness and ease of opening and closing.*

These Wheels are SPECIALLY DESIGNED and ADAPTED to

PAPER and PULP MILL PLANTS.

OBSERVE THE UNEQUALED SPEEDS, POWERS, AND EFFICIENCIES.

Test of a 45 inch SAMSON Wheel, Jan. 25, 1897.

Gate Open.	Head	Rev. Per Min.	Cu. Ft. Per Sec.	Horse Power.	Per Cent.
Full	15.00	144.00	172.69	240.97	82.03
5/6	15.04	138.12	155.03	223.61	84.55
3/4	15.11	127.67	133.24	191.06	83.68
2/3	15.88	131.50	112.65	162.80	80.25
1/2	16.47	126.87	90.04	127.73	75.95

Average efficiency 1/3 to full gate, 81.29 per cent.

Test of a 35 inch SAMSON Wheel, Feb. 1, 1897.

Gate Open.	Head	Rev. Per Min.	Cu. Ft. Per Sec.	Horse Power.	Per Cent.
Full	15.29	194.25	102.02	143.44	81.06
5/6	16.56	187.75	92.15	146.73	84.78
3/4	17.33	178.50	83.95	138.40	83.88
2/3	17.54	176.40	68.82	109.64	80.09
1/2	17.68	168.30	57.69	88.14	76.19

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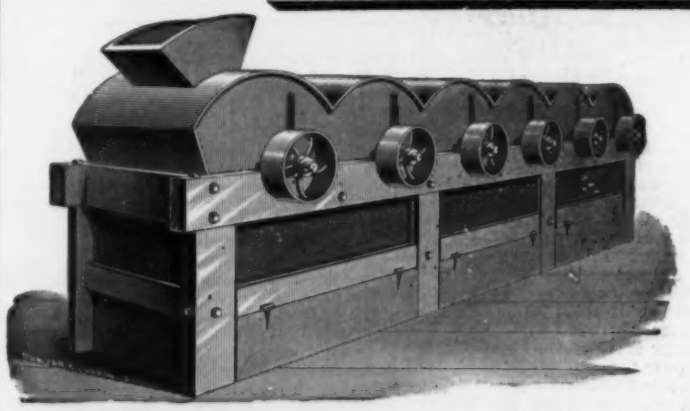

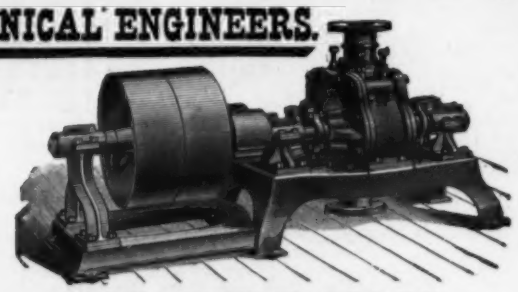

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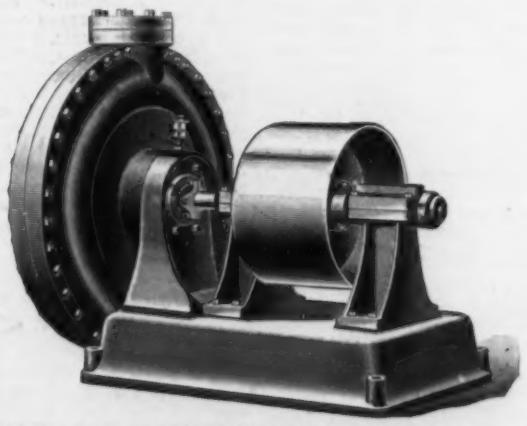

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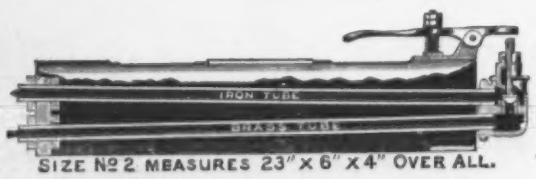

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AMERICAN PAPER AND PULP ASSOCIATION.

(*Continued from page 170.*)

Then, too, books increase with such amazing rapidity; what is to be done with them? If the British Museum still keeps a copy of every book published, how soon will its forty acres, more or less, of space in the heart of London be insufficient for its purposes? Fossil books are not like fossil rocks. They have the power of reproduction by new editions. They have, too, something approaching an earthly immortality of their own.

Many years ago a writer in the Atlantic Monthly drew a fanciful picture of an age far in the future, when the whole world, such as we have known it, should be buried beneath volumes past all enumeration. "There was neither fauna nor flora, neither wilderness, tempest, nor any familiar book of nature but only one boundless contiguity of books. There was only man and space, and one unceasing library. Nature was transformed into the processes and products of writing and all resources for anything else had fled from his universe. Anon, some wrinkled, fidgety, cogitative being in human form would add a new volume to some slope or tower of the monstrous omni-patulent mass, or some sharp-glancing youth, with teeth set unevenly on edge, would pull out a volume, look greedily and half-believingly for a few moments, return it, and slink away. 'What is this world, and what means this life?' cried I, addressing an old man, who had just tossed a volume aloft. He glanced a moment, then spoke, like a shade in hell: 'This is the world, and here is human life. Man long enjoyed it with wonderful fulness and freshness of being. But a madness seized him; everybody wrote books; the evil grew more and more; naught else was an object of pursuit; till at last the earth was covered with tomes, and for long ages it has been buried now beyond the reach of mortal. All forms of life were exterminated. Man himself survives only as a literary shadow, each one writes a book, or a few books, and dies, vanishing into thin air.'

This picture is altogether too fanciful and remote to disturb the serenity of the present age. History, as has been often said, moves by indirections. The peculiar proficiency of each epoch must work itself out; then a new course and a new aim, and, this attained, the series begins again. But the long, slow movement is always toward the higher plane.

At my home, in Portland, there is a broad and pleasant street, sloping on the north to Deering's Woods, on the south to the harbor and the opening bay. Upon the summit, between the slopes, stands a statue of Longfellow, within sight of the scenes with which his boyhood was familiar. On the northern slope lives Thomas Brackett Reed; a little farther to the south is the old mansion where William Pitt Fessenden lived, now the home of Judge Putnam, of our Federal Circuit Court of Appeals. Still further southward, on the sunny slope nearer the harbor, is the home of a man much more nearly related to this association and to the interest of this occasion; whose early career, not yet in its meridian, has already filled one of our fairest river valleys with flourishing communities, and laid there the deep foundations of future cities; who stood alone one winter's day not so long ago, less than a score of years ago, farther up the valley from Otis Falls, where even at that time a great success had been achieved in a wilderness almost unbroken, where the Androscoggin rolled over the grandest waterfall of New England, and then heard no sound save its own dashings, and there, in the inspiration of the moment, forecast the future; a future of the construction of a vast system of waterworks and waterways, canals and dams, mills and factories; with road and railroad winding slowly up the difficult river bank; with streets and homes, churches and schools, with teeming, throbbing, busy life and the thronging thoroughfare. The village of Rumford Falls, as it spreads out over the level lands, or climbs the mountain sides of that beautiful valley, is the beginning of the realization of that dream, the first lines of the prophecy fulfilled; but all that dream and all that prophecy shall yet come to pass.

I speak proudly, not boastfully. When you, gentlemen of the American Paper Manufacturers' Association, representing this vast interest and industry of our country, are making up your jewels, and you ask us in Maine for our contribution in this department to the illustration of the true genius of business life in the present age, I hope you will allow us to take you to these villages of the upper Androscoggin Valley, villages now, cities to be, founded by your distinguished president and his associates. These are our jewels, and they will be our reply. (Applause.)

The President—The next speaker needs no introduction from me. (Applause.) I see you all know him. He was well known and affectionally regarded by you all long before I became connected with this association, and he has always been prominently identified with its best work. No one, therefore, is better qualified to respond to the next toast, which is "Our Anniversary," than the Hon. Warner Miller. (Applause.)

Response of Warner Miller.

Mr. President and Fellow Members of the Association—I suppose I have been called on to respond to this toast because I am the youngest of the ex-presidents. (Laughter.) Colonel Paine didn't hear that. I preceded him some years in this office, but I am many years his junior. An anniversary is always an occasion of jubilation. I am happy to be able to say that this anniversary appears to be much more joyous than the one of a year ago. Things have changed. We have been on the toboggan slide since 1893 and we have got to the bottom, and now we are going up. (Applause.) We have heretofore had one good dinner a year, and for the other 364 we have gone poorly. In other words, as Colonel Knapp has expressed it, we have been philanthropists, working for his benefit and that of his brethren. But to-night everybody seems to be happy—happy in anticipation of the future. The changes that we see before us, the prospects of a revival of business and a demand for our products, have led many of us to believe that we may be able to have a good dinner like this, at least once a quarter. (A voice: "Good. Go on. That's right.") That expression, gentlemen, comes from Wellington Smith, who was one of the early presidents of this association. Now I hope to stimulate the ambition of every man here by saying that no president of this association has ever died; they are all live men (applause), and we intend to be alive and celebrate the golden anniversary. How many years off that is I don't know—twenty-five or thirty—but Wellington Smith and myself and Mr. Chisholm and Colonel Paine will be here. (Applause.)

Wellington Smith—I don't expect to be here; but go ahead. (Laughter.)

Mr. Miller—The syndicate will take care of you, all the same. I recall to-night the first meeting of this association, when it was organized. I was a younger man and much lighter in avoirdupois. Then, you know, we met in Saratoga, and we drank the spring waters. They were not conducive to avoirdupois, although they may have been to health; but we have changed now from Saratoga to New York, and, instead of effervescent natural waters, I judge from the appearance of these tables that the American paper and pulp maker has learned to take something for his consolation. It was Dr. Oliver Wendell Holmes, of New England fame—and I say that for the benefit of my New England friends—who said in his philosophy that a man who didn't take a little something for his creature comfort after he was fifty years old was at least a fool.

Wellington Smith—That's right. (Laughter.)

Mr. Miller—I want you to understand that this speech is put up between Wellington Smith and myself. (Laughter.) Now I want to say something for the benefit of our president, and I want Smith to keep quiet. Two years or more ago, myself and Mr. Warren Curtis, whom you know, thought we would go around and see what these young men in paper making were doing. We thought we knew something about the business, as we began at the beginning, but from the prices they were quoting we concluded we did not know very much. So we went up to this delightful State of Maine, to Otis Falls and to Rumford Falls, of which the judge has told us, and there we met a rosy-cheeked gentleman, who took us in, took us to his own private hotel, and gave us a dinner of chicken pie and apple pie, the best we ever had, but we were cold and weary; we had driven twenty odd miles over the hills through the storm, and we wanted something to comfort the inner man. And, will you believe it, the man who is now your president was then a teetotaler (laughter), and Curtis and myself went to our room, and from our own satchels we consoled ourselves by ourselves; but I want to say for your benefit here to-night that your president seems to have reformed. (Renewed laughter.) He now enjoys a New York dinner, and all its accompaniments. I told him the other day that if he did not change his habits he wouldn't trouble us long here in this city.

The paper maker is always a jolly good fellow, no matter whether times are good or bad; no matter whether Colonel Brown, of the News, over there at the further end of the room, wants to have his paper given to him and a chromo thrown in, or not. If he says so, we give it to him. But, nevertheless, we propose, one and all of us, to at least enjoy ourselves whilst we are here; and, as I have told you, a president of a paper makers' association never dies, nor very few of the rank and file. But since this organization was organized great changes have occurred. When I began in 1865 I thought myself very much of a man and a manufacturer. When I turned out three tons of paper a day, and when I got up to ten tons a day, I considered myself a good deal more of a millionaire than Mr. Mills here at my right is, and so I was then; and when we got up to 100 and 150 tons a day, why we were simply frightened at ourselves. But as Colonel Knapp has told you, we have made the modern newspaper possible. I recall the speech made here to this association a year ago by the lamented Charles A. Dana, the then father of the profession, the leader of the great editors of this country, when he gave us the credit of having made the modern newspaper possible. Well, the modern newspaper is a great institution; I admit that, but on Sunday mornings, when I want to rest and be quiet, and when three or four papers are brought in my room, of twenty-five and thirty, and forty and forty-two pages each, I wonder whether or not cheap paper is a blessing. (Laughter.) Colonel Knapp has told us what the modern newspaper is and what it ought to be. As to what it is, I agree with him fully. As to what it ought to be, I am not quite sure yet whether I agree with him or not. In order to be a great commercial success probably it must give the people what they want; but I prefer to look to the newspaper as a great leader of public opinion instead of a follower of public opinion; as the creator of public opinion; as the instrument by which you and I and everybody are to be taught our duties to the government, by which we are to be taught correct political principles. (Applause.) Perhaps I am too much of a Utopian. I know the millennium has not yet arrived, and, as a paper maker, of course I am in favor of the largest possible circulation of the largest number of pages of any paper that can be printed and sold.

But of our anniversary, of those meetings which we had in Saratoga, when we walked up and down Broadway, and when we went into the park and heard the delightful concerts, and saw the beautiful ladies who were assembled in Saratoga in the summer, certainly those were most delightful occasions. I cannot fail to recall our own simplicity. We were very common people then; but there is one thing about it, we were independent people—every man for himself. The association was a gathering largely for social purposes. We did not undertake to control anything, or anyone. We met for pleasure, and we had it; and we adjourned and went home. Twenty years have passed, and our individuality has largely disappeared in the tremendous contest of the present and the wonderful growth and development of our industries and the demand made upon them, and the single individual is as a pigmy. He cannot stand alone. Combination comes against him. The demand for increased product, for increased capital, is more than he can meet. The demand made upon him for foreign trade is entirely beyond his possibilities. The result is that he capitulates and goes in with his neighbors. To-night I feel very much like that man described by our most delightful literary man, Edward Everett Hale, in that wonderful story of his of "A Man Without a Country," being that I am a man without a mill.

Wellington Smith—You are not without a dollar, though. (Laughter.)

Mr. Miller—I don't know exactly where I am.

Mr. Smith—I will loan you a mill. (Laughter.)

Mr. Miller—I wouldn't dare take it as a gift. It would ruin all I have saved, and there would be no possibility of success in that way. Now, what are we to do? Colonel Knapp says we are philanthropists. I have made many contributions for foreign missions. I did not know I was so much of a philanthropist in my business transactions as I have learned to-night. Still I know we are, when he reminds me of it. Some years ago I attended the dedication of a wonderful palace in this city built by and dedicated to the interests of the press. It belonged to one of the great papers of this city—a paper which a few years before had not been worth anything, and which nobody would trust, but suddenly it had become a great institution and built an enormous and splendid building, and, as I had contributed to its growth and success, I was invited to the dedication. I took occasion then to say that the benefits that had accrued to that institution and others like it, by a creation of cheap paper made out of wood, with which I had had something to do, would much more than pay the entire cost of the institution every year in the saving that had been made. I never thought the institution quite liked me for that statement; nevertheless it is true, and what is true of that is true of the institution of Brother Knapp and of thousands of others throughout the length and breadth of the world. But, thank God, we have ceased to be philanthropists. (Laughter.) Now we simply propose to have a very modest 6 per cent., and we hope to get it, and we hope everybody else will get it with us. Somebody asked me the other day after I got rid of all my mills what I was going to do, and I said I was going fishing and hunting for the rest of my life. (Laughter.) I could live on very little anywhere in the woods, and I would watch the growth of the spruce trees; for without spruce trees Brother Knapp and Brother Pulitzer and Brother Reed couldn't get on at all—they wouldn't be any better off than we are.

Now I am talking altogether too long. There are other speakers to follow me. This association of ours, while it has had apparently but little of business in it, has had much of pleasure in it and it has brought our people together and they have come to know each other and to trust each other much more than ever before. And I want to say in regard to this meeting this year and this banquet that the organization has been treated to the most important programme that has ever been presented to it. Much of scientific value has been given us; and, laying aside the mere social life of an occasion like this, enough has been said during the past two days to furnish us much food for thought and profit, if we take it home and consider it; and this banquet is the greatest and finest we have ever had, and I think we owe a vote of thanks to the officers of the association this year who have brought about this result. (Applause.) So I hope from this time on these meetings will be what they were of old when the times were more prosperous; when we were selling cheap paper for 26 cents a pound to the newspapers. (Laughter.) Now, Colonel Knapp is a young man and he does not remember that time, but I do. We have no expectation of ever getting any such figures as that; but we are modest and moderate in our demands now. All we ask of the newspaper publishers of this country is that we shall be allowed to live—I was going to say like gentlemen, but that is perhaps a little too much, and I will say like moderate individuals; that we shall have comfortable homes in the country, where it does not cost too much to live; that we may have steam or furnace heat in our houses; that we may have kerosene oil to burn for light, and roast beef at least three times a week.

Mr. Smith—Once a week is enough. (Laughter.)

Mr. Miller—Once a week Smith says; but he doesn't look like that. He doesn't get that prosperous look of his out of the paper business, he gets that out of the Pullman Car Company. (Laughter.) As I say, we hope to be allowed to go on in our quiet way. We have no ambition for such a palace as this. We do not begrudge our friends in the newspaper fraternity the wonderful palaces which they occupy; but, nevertheless, as we wander about in the Adirondacks, or in the wilds of Canada or of Michigan, looking out for timber to make into paper, we do think that we ought to be able to meet our bills and to pay our ordinary traveling and living expenses. More than that we do not care for; for that is all there is of life anyhow. I see before me to-night men who are wearing dress suits whom I have met in the Adirondacks dressed in blue flannel shirts and top boots, sleeping in the open air and prospecting for spruce, for the benefit of the world and the editor and Colonel Knapp, and I have no doubt they were really happier then than they are to-night in this rather restrained society.

I asked a friend of mine to give me here to-night a statement in regard to the growth and development of this business since we began as an association. The statement I have before me will only take about a minute to read. It goes back to 1881, three years after we were organized. From 1881 down to the present time the growth of our business has been only 395.5 per cent of increase—nearly 400 per cent. of increase since 1881! And, gentlemen, that has all come out of our brains; and we have got mighty little of it. We have wandered here and there; we have employed the best scientific men in the world, and we have produced this result. We do not begrudge it at all to the world or to the newspaper publishers. I was very glad to hear Colonel Knapp say he did not want to go outside of this country with his business. You see, he has a protective tariff. You cannot publish the St. Louis Republic in London and bring it over here, nor in Berlin, nor in Paris. It can be printed only here. For the newspaper publisher the tariff is prohibitive. But we do not care anything about that question at all. In 1876, before this association was organized, I had the pleasure of standing before the Ways and Means Committee of the House of Representatives and listening to Erastus Brooks and George Jones when they made an argument against protection on paper. Then paper was worth about 9 cents a pound, and I said to the committee: "Gentlemen, if you will leave this alone, in five years we will reduce the price 50 per cent." We did it, and we have kept on reducing it. I won't undertake to say what the price is now, because it will be higher to-morrow morning. That was the result, and that has been the result of our work. We have gone on developing until we have come to this condition, where we are not only supplying the home market at a price which is from 10 to 25 per cent. less than the market price elsewhere in the world, but last month we sent abroad to England, to Japan, to Australia and to other foreign countries 250 tons of paper for every day in the month (applause), and we propose to make it 500 tons a day before eighteen months shall have rolled around. (Applause.) We are able to do it, and to compete in the markets of the world. We do not ask very much here at home. I have told you what we ask—namely, simply board and lodging and clothing—and we will try and make up the difference of the balance which we ought to have from the foreign trade. The American paper manufacturer has before him the markets of the world, and he proposes to take them. (Applause.)

This association can congratulate itself on having been a great success—not in the matter of controlling prices, for we have never attempted that, but in getting men acquainted with each other, and bringing about a friendly and brotherly feeling, so that we have all labored for the common good. To-night we are glad to welcome here in our midst representatives of every important industry, and especially representatives of the industry of newspaper publishing. They are part of us. It is only another branch of our industry. We are producers of the raw material, and they finally finish it and send it out to the people. I am very sure from my knowledge of them and my association with you for the past twenty-five years that they only ask of us that we shall give them the best products that we can produce, and at a fair and reasonable price.

Finally, I want to say to you in regard to the ex-presidents of this association, some ten or more of them during the past twenty years, that though a few of them are unable to be here to-night, I am very sure that the most cordial feelings go out from every one of us to William A. Russell, Byron Weston, and the others who are not with us. Thank God, they are all alive, and we shall hope to see them here on another occasion. (Applause.) I have simply this to say in conclusion, that this meeting has been the best we have ever had; that this banquet has been the most enjoyable we have ever had, and for one I hope that from this time on our association will grow in numbers and in strength, and that from year to year as we are gathered together we shall come here knowing that we shall enjoy the society of each other, and that from these gatherings much pleasure and profit is to be derived. (Applause.)

Wellington Smith—Mr. President, I see there is but one other speech.

The President—Two more.

Mr. Smith—Well, sir, I think this is a very opportune time for us to express our thanks and approval of the present management of this banquet, and of the order of exercises that have been arranged for this meeting. I therefore move that we heartily endorse all the arrangements that have been made. And, gentlemen, I will put the motion myself. All in favor of that will please say aye; contrary minded, no. (Carried unanimously.)

The President—Our next toast will be responded to by one whose reputation as a brilliant writer and speaker is well known to you all; and, while his toast is "The Debt of Literature to Paper," I am sure that when he has finished, we shall all agree that he has more than repaid the debt.

I have the honor to introduce to you William H. McElroy.

Response of William H. McElroy.

Mr. President and Gentlemen—Somebody has said that Lady Macbeth may have been a lady, but she couldn't prove it by her conduct. I think we will all agree that this dinner has been a success in every particular, and that we have all proved it by our conduct. When my distinguished friend and old classmate, Warner Miller, told that pathetic story in regard to his experience in Maine when it was so dry (laughter) I recalled an incident told me a few years ago in regard to a New York paper manufacturer. His doctor told him that his lungs were in such a state that he ought to go up into Maine and recuperate. Sitting one evening in a Portland hotel there came a violent hail storm. Hail stones up in Maine are no laughing matter. They came down bigger than hen's eggs, and this man from New York was observed to turn aside and drop a tear, and when the proprietor of the hotel asked him what made him so lachrymose, he said: "I hate to see so much cracked ice wasted on a prohibition State." (Laughter.)

In the course of his charming speech Judge Symonds said there was something witching about paper. I wonder if the judge recalled those beautiful lines of Longfellow:

Kind messages that come from land to land,
K nd letters, that betray the heart's deep history,
In which we feel a pressure of the hand—
One touch of fire, and all the rest is mystery.

(Applause.) I felt that I would be a welcome guest here to-night, for, although I have never made any paper, I have been the cause of a good deal of paper making by others. I write a large hand. I never write save on one side of a sheet, and I am the possessor of a style which, if not forcible, is diffusive. (Laughter.) Therefore I was sure that you would look upon me with a kindly eye, and I have this to say in the confidence of this room, I have found you all as I have met you as approachable as a candidate for Congress in a close district. (Laughter.) So it may be possible, inasmuch as we read that "the gratitude of place seekers is simply a lively sense of favors to come," that your hospitality has in it something of the tinge of that thrifty presence of mind. (Applause.) I remember that when the king of the Cannibal Islands died some years ago, some one suggested that this epitaph should be inscribed on his tombstone: "Here lies one who loved his fellow man." (Laughter.) And so, gentlemen, by easy stages I approach my toast. (Laughter and applause.)

If I were a paper maker I would exalt the horn of my vocation as high as the Eiffel Tower. Why? Because it seems to me that the paper maker may claim that if his name is not to stand in the angel's book of gold quite as high as Abou Ben Adhem's that he is indeed what he has been named here—one of the greatest public benefactors. (Applause.) When we men of the press get up on occasions of this kind, with characteristic moderation and modesty (laughter) we always claim that since the morning stars first sang together no boon has been conferred upon mankind equal to the newspaper. But the paper maker may say to us right there: "Go to! now. How would you editors be able to express your mental and spiritual activities were it not for paper?" You remember that the Irishman in the old story put to himself the searching question: "What is the whole world to a man when his wife is a widow?" (Laughter.) And the paper maker may well say to the editor: "What shall it profit you if you have a large assortment of original and selected ideas to express, if, owing to a temporary embarrassment in the counting room, you are out of paper?" (Laughter.) And so it is that I say that if I were a paper maker I would claim that I was the power behind the throne of the fourth estate; or, at all events, that I was one of its essential properties.

Now, of course to be fair we must remember that some writers get along without paper. When Miller and I went in to our examinations, at Union College, we had on our shirt cuffs certain aids to memory. (Laughter.) About the same time, when we strayed away from college and went on a picnic, we were accustomed to carve on some sympathetic tree that wouldn't tell the initials of our best girl. You also recollect that at Belshazzar's feast, and all the political campaigns which you and I recollect, there has been what we call "writing on the wall." (Laughter.) And, furthermore, I remember some years ago a novel was published which stated as a veritable fact that a shipwrecked sailor on a desert island with some young person—presumably his wife (laughter)—finding that his end was near, and, being out of stationery, put his last will and testament in tattoo upon her neck (laughter); and actually, it is told as a veritable fact also, that the girl subsequently returned to England and was admitted to probate and placed on file. (Laughter.) But of course these are the exceptions that prove the rule. The average man when he is confronted with Philip Sidney's admonition, "Look into thine own heart and write," does not order a shirt cuff, does not order the bark of the tree, or even the neck of the prettiest girl, but he says "Paper is good enough for me." (Laughter.)

Now, gentlemen, it follows from this, I take it, that literature owes a great debt to paper. The greatest name in our English literature is Shakespeare; but if he is to endure, not for a day only, but for all time, if his marvelous setting forth of the human soul, its glory and its shame, its hopes and its despair, its love and its hate, if this is to be done, it is only because the transcendent output of his genius is given permanence and diffusion by the output of the paper mills. (Applause.) The great brainy Rufus Choate, in my judgment, never said anything more forcible and felicitous than when he exclaimed, "A book is the only immortality!" Some years ago I had the pleasure of going through the cathedral towns in England. Here and there I noticed a defaced column. I noticed a wonderful stained window hopelessly defaced. I noticed a statue mutilated. When the guide saw that I was disturbed by this he said: "This happened when Oliver Cromwell's men went through England." Henry W. Grady, that great Southerner, who died before his splendid fame came to its full power, once said here in New York, in a speech, which at once went all over the continent, speaking of General Sherman, who sat next to him at the table: "Sherman is considered a very able man in the South,

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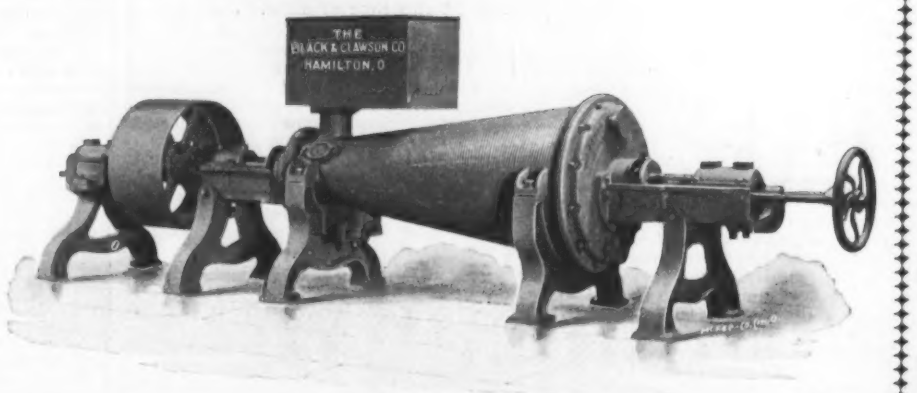

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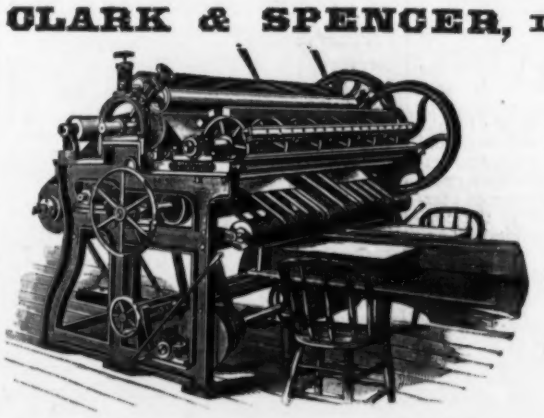

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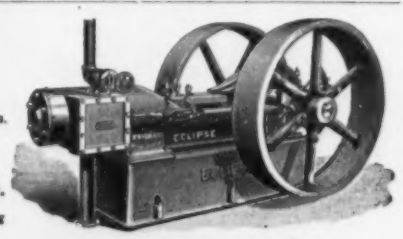

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Especially adapted for Pulp Mills, Paper Mills Tanneries, Wreckers and all purposes when a large volume of liquid is to be raised.

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No wearing out of Scroll on Pump Wheel.

Sleeve Box and Flange entirely original in this Pump.

Many new features, all mentioned in Catalogue, which can be had by writing us.

For fire purposes this Pump unequaled.

but some of us in Georgia think he was a little careless with fire." (Laughter.) Now these men of Cromwell regarded art as an impertinence, not to say a profanity, and accordingly they made sad havoc. But remember, gentlemen, such is the art preservative of all arts, they could not touch literature! The rare and radiant Juliet survives untouched in her magnificent beauty and renown. King Lear survives. Portia survives—all the great creations of that great artist survive. Truly, a book is the only immortality! (Applause.)

I am reminded right here of certain embarrassing experiences that alleged contributors to literature have had. They think they are doing something for that great estate of literature, but sometimes it turns out that what they endeavor to make writing paper simply ends in being wrapping paper; and there is no sadder story in all history than the fate of Augustus. He was a young poet who sent to one of the great metropolitan papers a little sonnet, entitled "Why do I live?" The paper failed to publish it, but one day, in the answers to correspondents, was this: "To Augustus—You sent us a little introspective sonnet, entitled 'Why do I live?' We got it by mail, Augustus, and you live because you did not bring it around to the office in person." (Laughter.)

Just a word more, gentlemen, and I will relieve your patience. The pilgrim who goes into the famous picture gallery in Dresden finds it an event in his life when he crosses the threshold of the room in which abides in her unrivaled beauty the Sistine Madonna. Gazing into her inexpressible eyes, I think any man who has a soul within him feels thundering in his ears the admonition: "Take off the shoes from thy feet, for the place whereon thou standest is holy ground." Nevertheless, some crank with a jack knife, or with a torch, in the twinkling of an eye could forever rob mankind of that great treasure. But, thanks to paper, no man is able to disturb those great constellations that flame in the sky of literature, and which are forevermore the consolation, the recreation of mankind. (Applause.)

May I add just a single word. When I listened to the band a little while ago playing "My Country, 'Tis of Thee, Sweet Land of Liberty," and then "The Star Spangled Banner, Long May It Wave," it occurred to me that the Maine incident, the blowing up of that vessel, must be in every mind. I am sure we all devotedly wish that it may turn out that this awful casualty may have been still an accident (applause); but I am sure that if it turns out to be something graver, something far different than this, that forgetting all differences we will stand like a wall of brass for the defense of the nation's honor, remembering Lincoln's admonition: "See to it that government of the people, by the people, and for the people, shall not perish from the earth." (Applause and cheers.)

A Voice—"Telegraph that to McKinley. He needs it."

The President.—We have with us tonight a near and dear friend of the association, without whose presence our banquet would be incomplete. The Rev. Dr. Minot J. Savage will now respond to the final toast, "The Man of Affairs. (Applause.)

RESPONSE OF REV. M. J. SAVAGE.

Mr. President and Gentlemen of the Association—I was told last year, through the kindness of some one who claimed to interpret the feeling of this body, that I had been appointed permanent chaplain of the paper makers of the United States. It is the business of the chaplain to pronounce the invocation, and, at the end of the services, the benediction. If I am to keep this position, and the favor which I am so grateful to you for having won, I must be merciful to you at an hour like this, in the matter of time. You know when a minister on a certain occasion asked one of his parishioners what he thought should be the proper length of a sermon, the reply was, "About twenty minutes, with a leaning to the side of mercy." (Laughter.) One of my parishioners is present here, and I know he smiles as he thinks how far away from that ideal I myself come on Sunday mornings.

Now I know that the gentlemen who live in New York are already anxious to be at home. (Laughter.) If they stay out much longer they will be in the condition of the gentleman I once knew of who, as he was going home at a very late hour, or an early hour, during the night, said to his friend—there were two of them—"What are you going to say to your wife when you get in?" The other replied: "Oh, I shall just say, 'Good morning,' and she will say the rest of it." (Laughter.) So I know that these gentlemen who live in New York are anxious to get home, and those who have come here from abroad and who have been devoting themselves faithfully to the science and the art of paper making are anxious to investigate the condition of New York at this time of night. (Laughter.))

I am expected, I believe, to speak of "The Man of Affairs," but I only found it out a day or so ago, and I know it was worded that way simply to make a general and indeterminate doorway through which I might enter and say just what I pleased. You are engaged in the manufacture of paper. It is my business, if I am true to my vocation, to do what I can to make manhood, and I wish to point to one magnificent specimen of the output of the church that is located on the corner of Thirty-fourth street and Park avenue. I refer to one of your ex-presidents, Colonel Paine. (Applause.)

The President—He is exhibit A. (Laughter.)

Dr. Savage—I know that after your pleasant acquaintance with him and the high esteem in which you hold him that if you gentlemen who have come here from abroad were living in New York you would all want to be my parishioners, and I should have to enlarge my church to make room for you. I have had some personal acquaintance with the president of the present year. Two or three years ago I had the pleasure of crossing the ocean with him. I am not going to tell you all about him on the voyage and on the other side. I am very fond, though I do not get an opportunity often to indulge my taste in that direction, of a game of whist. I started a game on the steamer as we left Liverpool and sailed for New York, and the president of this association came along and looked over my shoulder and asked me what the ante was. (Laughter.) I saw from that that although he knew a great deal he didn't know whist; but I found, as you have found in regard to the work in which you are engaged, that he was a very apt scholar. He made one of four for several days as we played the game and he picked it up rapidly. Now and then he would make a mistake and refer to something that I knew very little about. I remember the words "straight" and "flush" and so on, occurring two or three times (laughter); but on the whole he got along so well that he was frequently the winner of the game, and I have no doubt that if he has kept it up since he is the most distinguished player to-day in the State of Maine, because he gets to the top of any profession in which he engages. (Applause.)

I have been asked since I have been sitting here to settle the question, which the last speaker referred to just before he sat down, as to our relations with Spain; I have been asked if I would not talk about Hawaii, and as to whether we had better annex those islands to the United States. I have also had it in mind to discuss the Eastern question, the relations of Germany and Russia and England in China and the Far East. I could undoubtedly settle any one of these themes to your satisfaction if it were not quite so late. I indorse most heartily that which has just been said in regard to the sad disaster in the harbor of Havana. I have wondered at the patience of the people of these United States. We have been stabbed and thrilled from head to foot by the sufferings, the massacres, the robberies, the cruelties, the inhumanities in Armenia, and yet worse than these have been committed here at our very door and we have been infinitely more patient in regard to them. I am not an advocate of war. I wish that the world might be civilized enough to settle all these great problems by a process of peaceful arbitration, but I hope that the outcome of this present struggle may be a Cuba that is free and a friendly ally of the Unted States. (Applause and cheers.) I would not infringe the rights of any country with which we are at peace in order to attain this end; but the limit of patience and humanity may come, and I believe that we ought to be ready when that time is here to stand up for the principles of freedom and manhood on which, if anything, this country rests as a secure foundation. (Applause.)

One word let me say in regard to the problem in the East. We have lost one battleship. I believe for the sake of peace, for the sake of humanity, that we ought to have, commensurate with the power, the dignity, the greatness of this country, a navy (applause); and, since we cannot construct ships as rapidly as perhaps the situation demands, if there are any first-class battle ships for sale anywhere around the world I would buy them to-day, until we have a navy that should give us power so that we may dare to assert our will and carry out the great principles for which we stand. (Applause.) I think England to-day in her assertion in favor of the open ports of China is right (applause), and I believe that the United States ought to stand shoulder to shoulder with England. (Applause.) But it is only idle talk unless we are in possession of the power to enforce that which we say.

Leaving these questions, now just one word: Some one has said to-night, and it has been repeated more than once, that you gentlemen are philanthropists. Do you know, I believe that any man who creates and conducts an honest business which gives employment to a large number of men, and helps on the conditions which are necessary to civilization, though he does not give a single cent in the course of a year, is unspeakably more of a philanthropist than the man who merely gives away his money to the poor? (Applause.) The aim of civilization should be to give employment to men, so that there shall be no dependent and pauper poor. (Applause.) If I had time I think I could show you to-night that the business of the world is the grandest instrument for carrying on the divine work in the civilization and uplifting of mankind. The business of the world has created permanence, has created truthfulness; the business of the world has done more to break down the barriers between nation and nation, and create a sense of human brotherhood, than all the preachers from the foundation of the world until to-day. It has brought men into vital relations with each other; and men only need to look into each other's faces and realize that they are brothers, and that their interests are identical, in order to realize this condition of human brotherhood. (Applause.)

I cannot stop to deal with that matter further. Always as I look into the faces of business men, the man of affairs—while I recognize the grandeur of his work I feel like asking him to think of the higher ranges of life. There cannot be too much money in the world. The world is suffering to-day not from a surplus of wealth, but from its poverty. But money; what is it? Money is the raw material out of which to create beauty and truth and love and womanhood and manhood; and it is poor stuff unless it be so transformed. (Applause.)

I remember once when a man, in his over-weening wealth, who had no appreciation of the higher side of things, was talking with an artist in a sort of patronizing way, not knowing his business, and asking him what he was doing, the artist said: "But for a fortunate accident that occurred when I was a young man I should have been nothing but a banker." I have nothing to say against creators of material wealth. They lay the foundations which make it possible to rear on those foundations the higher structures of noble manhood and womanhood. The last speaker referred to the fact that a book alone was sure of immortality. Look back for an instant and note the things that have lived. What are they? What are the things of the past that we value and prize to-day? They are the expressions of thought, of love, of the sense of duty, of a care for truth. These intangible ideal spiritual things are the only things that endure. That little country of Palestine, a little strip of land on the eastern shore of the Mediterranean, about as large as the State of Massachusetts, is famous and hallowed for all time! Why? Because of the prophets, the seers that lived and taught and spoke there; because its ground was trod by the sacred feet of the Nazarene, the Son of God, our Elder Brother. It is these spiritual forces that have made it forever famous. Study Greece, and you find there a similar truth. Whatever there is in the past that we care for to-day concerns these higher ranges of thought, and feeling and sympathy, and tenderness, love, and truth. And you gentlemen, if you wish to make the most of your money after you have created it—and I hope you will create a thousand times more—must transform it, lift it up, glorify it, and make it immortal, because spiritual and true. (Applause and cheers.)

The President—Gentlemen, this concludes our twenty-first anniversary.

Sample Room in Mexico.

United States Consul Magill writes from Tampico, under date of January 20, 1898, that there is a room in the consulate which can be used for exhibiting samples of United States products, such as soap, grain foods, cutlery, writing paper—in fact, the consul says, any article of small size that can be easily handled. He adds: "If manufacturers desire to take advantage of this, either I or my clerk will be glad to invite local merchants to call and examine the articles, and will personally represent their good qualities to the best of our ability. While we are very busy most of the time I think it would not interfere with our regular duties, and, if necessary, I would take time in the evening to explain anything I could. Of course, any charges for freight or delivery should be prepaid." Consul Magill has been authorized by the department to carry out the proposed plan, as being obviously in the interest of manufacturers of the United States, provided that all expenses shall be defrayed by the firms sending samples, and that no part of the proposed exhibition shall devolve upon the consulate.

New Corporations.

The Orator Publishing Company, Manhattan, N. Y., capital, $10,000, has been incorporated.

The J. M. Coe Printing Company, of Richmond, Va., has been incorporated; capital stock, $10,000.

American Ink Company, capital, $10,000, has been incorporated at Albany, N. Y. Office, Manhattan. Directors. Charles M. Palmer, Solomon S. Corvalho, Henry M. Bricknell.

The Charles E. Miller Publishing Company, Logansport, Ind., has been incorporated by C. E. Miller, A. G. Jenkines, S. T. McConnell and M. F. Mahoney.

For
FAST RUNNING
Paper Machines
The Patent Endless Felts of the
Albany Felt Co.,
Duncan M. Fuller, Gen. Supt., have proven themselves unequaled. Stand to their size and increase production materially.
Albany, N.Y.

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PAPER MILLS.

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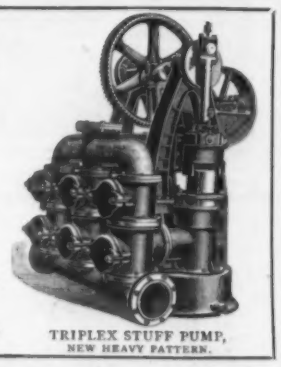
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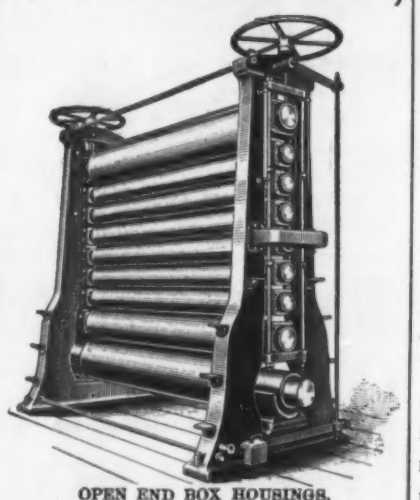

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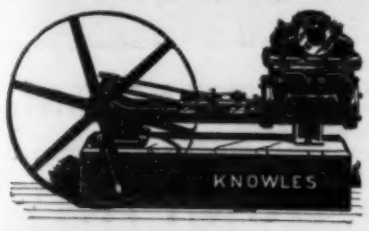

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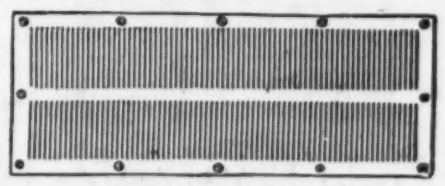

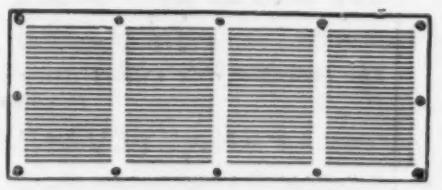

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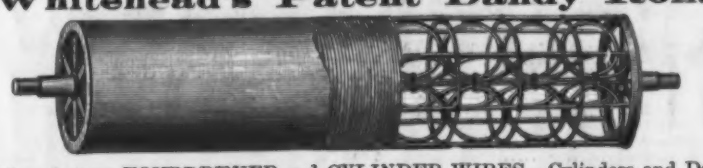

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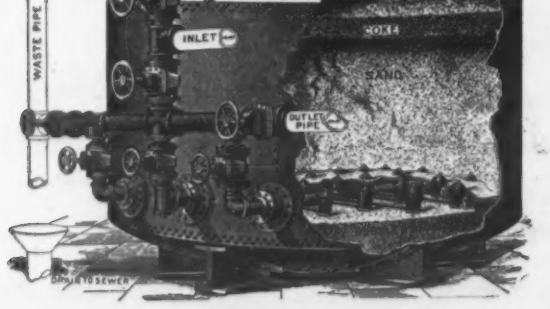

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